Household livelihood strategies and implications for food security and food self-sufficiency: A case of West Nile, Uganda

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1-16-2015

Acknowledgements

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January, 2015

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b) Total household net income (Y_N) was obtained as per equation 2:

$$Y_N = \sum_{k=1}^{n}(y_{ik}) + Vp - Cp, \quad (2)$$

Where y_k is the income from source k; V_p the value[1] of food produced on farm and available for consumption by households; and C_p, the external cost of production. In this case, total net income = Crop sales + livestock sales + Other off farm income + Value of consumed produce – Cost of production. Per capita income was obtained by dividing the total net income by number of household members.

2.2.2 Poverty line

Poverty line at household level was expressed as annual income in Uganda Shillings (UGX) for each household. Poverty line per capita per annum was calculated by considering household size, an income of USD1.25 per capita per day, and a conversion rate of 1USD=2600UGX.

$$\text{Poverty line per capita per annum} = \frac{1.25 \text{ x } 365 \text{ x } 2600}{\text{Household size}} \quad (3)$$

2.2.3 Food self sufficiency

Food self-sufficiency was measured based on food energy requirement by households against energy in food produced on farm that is available for consumption. This included all farm produce whether directly consumed or sold. The value of produce sold (both crop and livestock) was converted to energy using maize flour equivalent at an average price of UGX1,200 per kg of maize flour[2]. Cost of production were offset from the value of produce sold[3]. Food self-sufficiency was therefore calculated as in equation 4;

$$\text{FSS ratio}_i = \frac{\{\sum_1^p (Qty C_p * E_p)\} + \{(VP_{sold} - C_p/1200) * E_m)\}}{\sum_{j=1}^{n} Kj} \quad (4)$$

[1] Value of food produced on farm and available for consumption was obtained by multiplying the quantity of food by the median sale price as mentioned by the farmer.

[2]FSS considered all food items produced on farm. If farmers sold part of the produce, it was assumed that the money was used to buy other food items for home consumption.

[3]If farmers incurred cost of production, this would normally affect the net value of produce sold, and subsequently how much food they can buy with the available cash. On the other hand, farmers could still incur costs to produce food that is not primarily for sale. This study considered presenting both scenarios taking into account gross farm income and net farm income. This also gives a clue of whether production costs are significantly reducing food availability at household level.

Where $QtyC$ is the quantity of food item p produced on farm and directly consumed by households, VP_{sold} is the value of produce sold, both crop and livestock in UGX, C_p is the expenditure costs on production in UGX, E_p is the energy equivalent of food item p, E_m is the energy equivalent for maize flour, K_j is energy requirement in Kcal per capita for j member, and n is the number of members in household i.

Household energy requirements were computed based on adult equivalent. The study assumed same energy requirement for both adult male and adult female at 2500Kcal per day, while male and female adult equivalent for under 18 were 0.5 and 0.4 (of adult energy needs) respectively. Energy content for different food items was adapted from FAO[4].

2.2.4 Food security

Food security was measured based on food energy requirements by households *vis a vis* energy available from farm production and off farm sources. This study did not ask households how much food they purchased. The analysis thus assumed all off farm income to be used to purchase food. Food security was thus computed as:

$$\text{FSratio}_i = \text{FSS} + \frac{\sum_1^n (Y_{off\ farm}/1200) * E_m}{\sum_{j=1}^n Kj}$$

Where FSS is food self-sufficiency ratio, $Y_{off\ farm}$ is other off farm income by households, 1200 is the average price of maize in UGX, E_m is the maize energy equivalent.

2.3 Data analysis and interpretation

This section shows the analytical approaches used per study objective:

Objective 1: Assess the contribution of crop and livestock to incomes, food self-sufficiency and food security

The contribution of crop and livestock and other activities to incomes, FS and FSS was assessed using descriptive analysis and results presented in graphs for ease of visualisation. Bivariate regression analysis was done to understand the relationship between the study variables and other explanatory variables such as farms size, proportion of land allocated to crop enterprises

[4] http://www.fao.org/docrep/006/y5022e/y5022e00.htm

and livestock units. Inferential statistics using correlation analysis was also applied to understand the strength of relationships between household incomes and FSS/FS in order to assess the opportunity for addressing FSS/FS using off farm income sources. Analysis of variance was used to assess the variation in income between districts and within districts. Significant variation would mean that households are different thus justification for second objective.

Objective 2: Characterize household types in terms of their resource endowment, major production constraints and general livelihood strategies adopted

Principal component analysis was used to identify the factors explaining the most variability between the farms pooled across districts. The identified factors were then used to run hierarchical clustering of the farms to derive farm types that were relatively similar with respect to the principal factors accounting for between farm variability. The differences in the principal factors between farm typologies were evaluated to deduce the general livelihood strategies adopted within each farm typology. Farm household characteristics were evaluated by comparing means of the variables representing household human, natural, physical and financial capital, and how they are related to the major livelihood strategies.

Objective 3: Evaluate food self-sufficiency gaps for the different household types under current practice, and adequacy of current alternative sources of income to close the gaps

Based on categorisation of household typologies, the FSS and FS outlook were visualised for the various households. The study used the current food production and current income from alternative sources to describe FSS and FS for the various clusters of households. Descriptive analysis was used.

3 RESULTS

3.1 Descriptive results

Table 1 summarises the key household characteristics in the study districts. Households in the study districts were mainly engaged in crop farming, from which majority derived their livelihoods. Major food crops grown in the zone included cassava, beans, groundnuts, simsim and sweet potatoes. Cotton was important in Nebbi as a traditional cash crop, while onions were important in Koboko as non-traditional cash crop. Crop farming was the most important source of income for households in the zone, followed by trading and other off farm sources.

Households also kept livestock, albeit in very small numbers, and subsequently the contribution of livestock to households' incomes was relatively small compared to other sources of income in the region. The livestock kept were mainly local breeds of goats, cattle and chicken. Household size ranged from 6.5 to 7.7 members, with the dependency ratio greater than 50% in all districts. Farm size ranged from 2.3 acres (lowest in Zombo) to 4.8 acres (highest in Nebbi).

Table 1

Main household characteristics across the study sites

District	HH size	Dependency ratio*	Av. farm size (acres)	Cropping (% HH)ǂ	Main crops	TLU	Main livestock	Main income sources
Arua	6.8±0.2	0.5±0.02	2.77±0.2	70	Cassava, beans, g/nuts	1.16±0.13	Chicken, goats, cattle	Crop, trading, permanent off farm
Koboko	7.7±0.3	0.6±0.02	4.02±0.2	96	Cassava, beans, onions	2.99±0.27	Chicken, goats, cattle	Crop sales, trading
Moyo	6.2±0.2	0.6±0.02	3.63±0.2	64	Cassava, sorghum, s/potatoes	2.28±0.26	Chicken, goats, cattle	Crop sales, trading, off farm
Nebbi	7.1±0.3	0.7±0.02	4.76±0.2	100	Cassava, simsim, cotton	1.21±0.25	Chicken, goats, cattle	Crop sales
Zombo	6.5±0.3	0.6±0.02	2.37±0.1	99	Cassava, maize, g/nuts,	0.99±0.25	Goats, chicken, cattle	Crop sales, trading, livestock sales

ǂ proportion of household earning income from crops. The proportion and contribution of crop income to total household income varies across the districts (cf IITA/ZOA, 2014).

Note: Figures after ± represents standard error of means, s/potato = sweet potatoes, G/nuts = groundnuts

*Household members less than 18 years of age and more than 59 years are defined as dependants. The dependant ratio is calculated by dividing dependents by total household size

3.2 Contribution of crop and livestock to incomes, food self-sufficiency and food security

3.2.1 Household income source and variability across the study districts

Farm households in the study districts had diverse sources of income – crop sales, livestock sales, trading and other off farm which included remittances, casual labour, employment, agro-processing and pensions. Across the study districts, crop sales generally contributed the greatest proportion to household incomes compared to other sources of income (Figure 1), though proportions varied by district.

In Nebbi, all the households earned income from crop sales, which also contributed almost 90% of total household incomes in this district. In Koboko, contribution of crop to household income was almost 50%, and over 90% of households in this district derived income from crop sales. In Arua and Moyo, even if crop income was important, less than 70% of households derived income from crop sales. In these two districts, income from trading and other off farm sources seemed to be very important contributors to household incomes. Similarly, trading was important in Koboko and Zombo. Contribution of livestock sales to household incomes was minimal in Koboko, and Nebbi, though it seemed to play an important role in the other three districts of Arua, Moyo and Zombo.

Assessment of poverty line per capita in relation to household net income, showed that majority of households in the study districts were below the poverty line (Figure 2). The situation was critically serious in Zombo and Nebbi, where up to 97% and 94% of households were below the poverty line respectively. Moyo had a relatively smaller proportion of households below poverty line (77%) followed by Koboko (85%) and Arua (86%). The result for Moyo is rather surprising considering that average household incomes were lowest in Moyo compared to the other districts (IITA/ZOA, 2014). In the same report, Moyo exhibited lowest yields (quantity per acre) for most of the crops.

The observed performance in terms of poverty line could possibly be attributed to the fact volume of production was high, though not necessarily better yield which contributed greatly to food available for consumption. Also households in Moyo had relatively fewer members which has a direct effect on the per capita incomes. When the available food was valued, it

significantly improved the poverty situation for households in Moyo. Also households in Moyo sold a small proportion of their food leaving a relatively large proportion that contributed to household food consumption, thus positively affecting poverty indicator.

Worth noting is that the poverty line figures obtained from this study contrast what is reported for Uganda by World Bank Statistics that put poverty level at 46% (UNPS[5], 2013). The difference may be attributed to the different measurement approaches used. This study used household income to measure poverty[6], while the World Bank largely used consumption expenditure. In addition, it has been widely acknowledged that poverty is not static, instead, poor people and indeed household change their state depending on several factors. Some stay in poverty over an extended period of time while others move into and out of poverty overtime.

[5]Uganda National Panel Survey (Wave III), conducted by the World Bank and Uganda Bureau of Statistics.
[6] UNPS (2013) indicate that poverty is multi-dimensional thus requiring complementary measures to fully understand it. This entails considering a combination of measures of wellbeing for instance material with education, health, vulnerability and deprivation among others. This study used income measures only, thus the results should be interpreted along with other indicators discussed in this report to understand the poverty situation in the study districts.

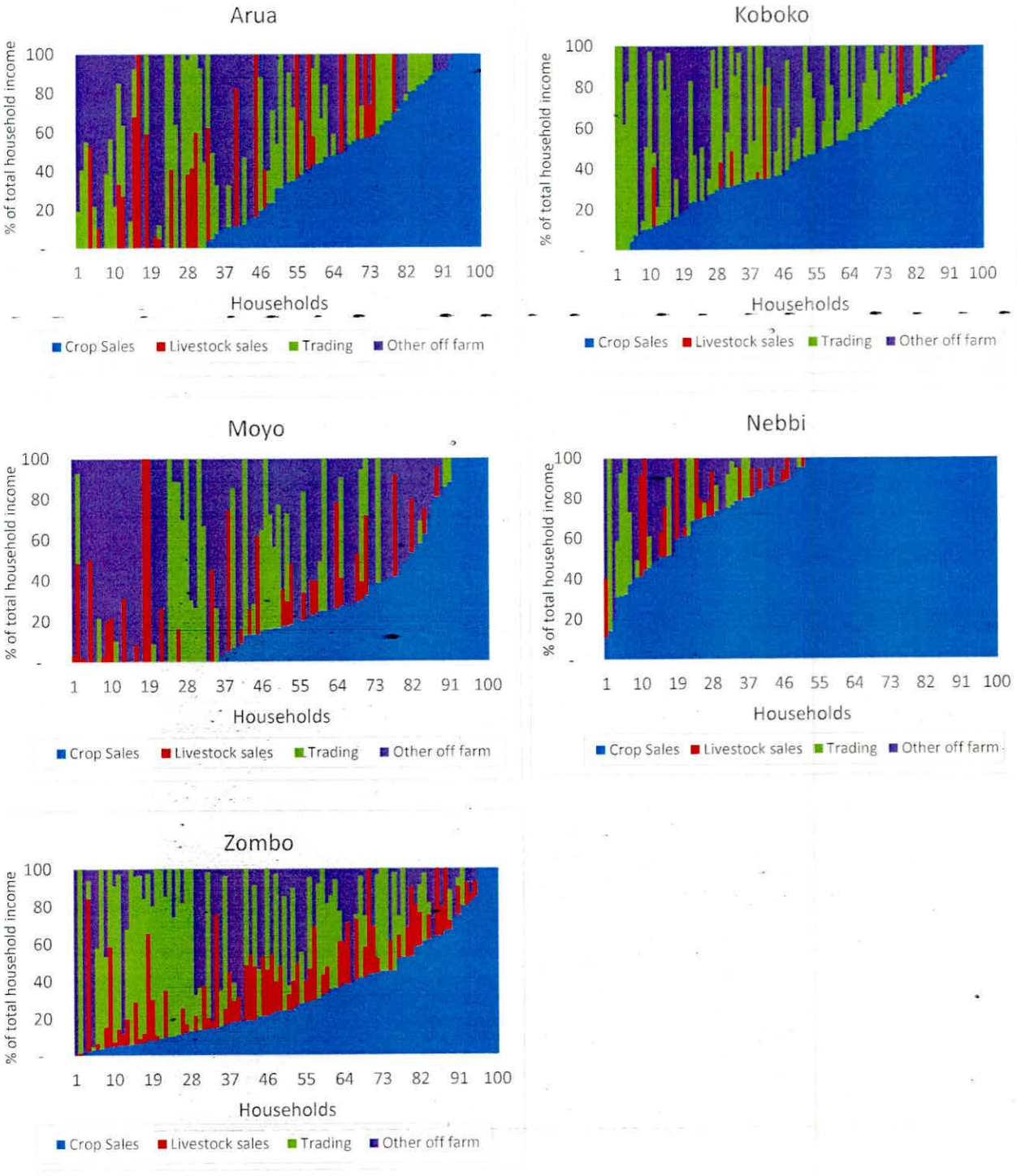


Figure 1: Income sources and their relative contribution to total household incomes

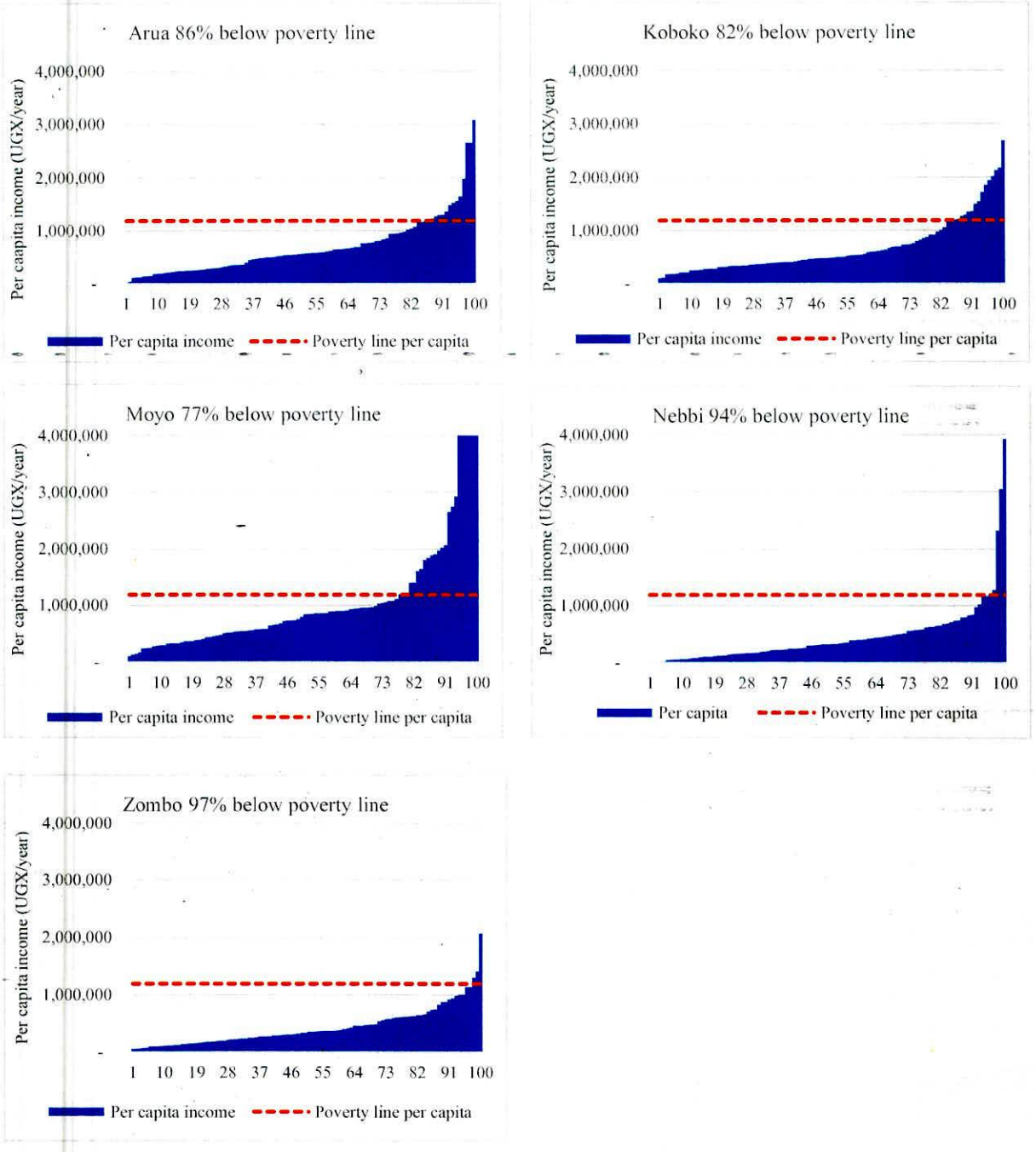


Figure 2: Household net income and poverty line

3.2.2 Variation of contribution to household income across farm size

Contribution of various activities to household income was assessed across districts using farm size as an explanatory variable. The five districts were ordered according to farm size – Zombo, Arua, Moyo, Koboko and Nebbi in that order from smallest to largest. Across different farm sizes, contribution of cropping activities to household incomes increased, while contribution of livestock and off farm activities decreased (Figure 3). The relative contribution of cropping activities increased from an average of 25% to about 65% with increase in farm size. Though contribution from livestock was generally minimal across the study districts, its contribution to household incomes reduced from about 15% to almost 0% with increase in farm size. Off farm income also showed a negative relationship with increase in farm size, with decrease up to 50% as farm sizes doubled.

The possible explanation for the negative relationship between land size and livestock could relate to type of livestock kept and the purpose. One could suppose that small farms may introduce livestock (small ruminants and chickens) as a diversification strategy since they may not be able to obtain enough food from their cropping. Income is also supported by higher off farm income sources for households with small farms. But with more land, farmers tend to specialize in cropping.

Analysis of variance of incomes showed significant difference in incomes earned by households within and between districts ($F=8.25$, $p<0.01$). Correlation analysis was also done to understand the relationship between household incomes and crop/livestock/off farm income, average farm size and household incomes. The analysis showed positive coefficients for all the variables, with crop income having the strongest relationship with household income ($r=0.67$), while average farm size had a positive but weak relationship with household income ($r=0.18$). This may be due to the fact that total household income is a combination of many sources, both off farm and on farm. Farmers were generally engaged on both off farm and on farm activities irrespective of land size, but as long as there was an opportunity to increase their income.

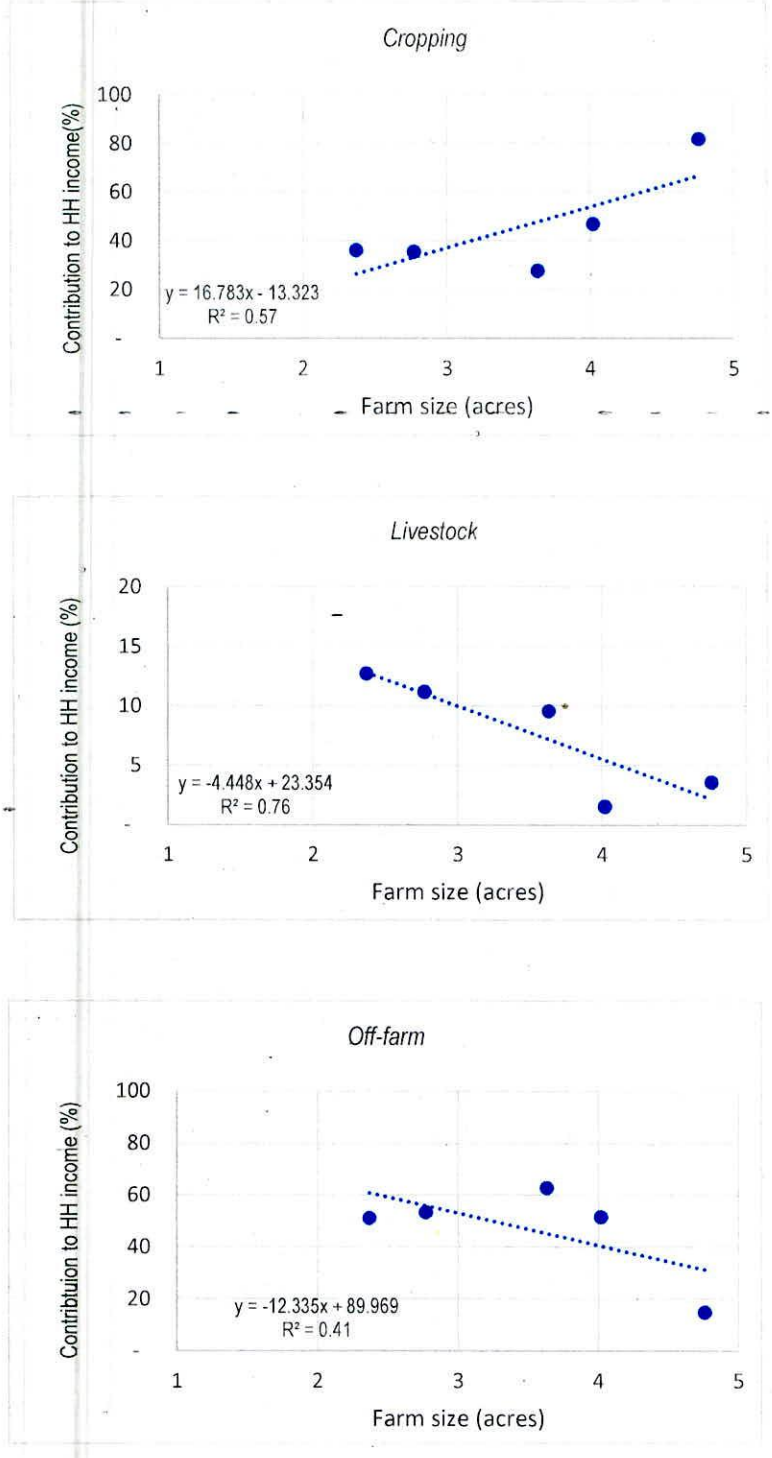


Figure 3: Contribution to household income of cropping, livestock and off farm activities in the five study districts

3.2.3 Food security and food self sufficiency

The contribution of crop and livestock to food security and self-sufficiency was assessed to further understand the food security status of households. This study considered food sources from on farm (direct consumption and value of produce sold, both crops and livestock) and off farm[7] (food energy equivalent from off farm income).

As indicated in the methodology, household food self-sufficiency was computed based on available energy from farm production (both direct food consumption and energy equivalent from farm income). The cost of production was offset from farm income to get net farm income which directly contributes to farm consumption (Figure 4). The study also considered an alternative approach, using gross farm income for estimation of FSS. In this case, FSS was computed based on gross farm income (income from crop and livestock sales – Annex 1). This comparison helps to assess whether production costs would significantly affect FSS at household level or not. The expectation is that the FSS should be significantly different explained by the cost of production, if farming activities are assumed to be homogenous.

Results from the first scenario (gross farm income) showed that less than 50% of households, across all the study districts were not self-sufficient in terms of food. Moyo showed the highest proportion of farmers (48%) not self-sufficient, and the lowest ratio was recorded for Koboko and Nebbi (27%). When net farm incomes were used to calculate FSS, the proportion of households less food self-sufficient in Moyo increased to 62% (from 48% when gross incomes were used). Nebbi still showed the lowest proportion of households that are less food self-sufficient (31%). In Koboko, the proportion of households that were less food self-sufficient almost doubled, when net incomes were used to compute FSS. Similarly, in Zombo, the proportion of households with less energy from farm production increased significantly.

The implication of the results is that, in Nebbi the greatest contribution to household FSS is from direct consumption of food produced at home, thus, with even small farm incomes, households would still have food. Similarly, in Moyo, households still depend more on direct consumption of food produced at home, but perhaps their production is inadequate to contribute significantly to FSS. The contribution from crop and livestock sales was very minimal in Moyo,

[7] In the study, questions were not asked on food bought by households. It was thus assumed that household income was used to buy other food items not produced on farm. This may not be the situation given that households have varied demands for money, but gives a rough idea of the food security situation of households and gives an opportunity to identify possible areas for optimization to achieve food security.

also affected by the high cost of production. The high cost of production in Zombo was also a key explanatory variable for the declining contribution of crop/livestock sales to household FSS.

The food security ratios for the five study locations indicated less than 25% of households as food insecure (Figure 5). The proportion of food insecure households was highest in Nebbi and Zombo at 25% and lowest in Koboko (5%). Off farm energy source was significantly important for households in Koboko, and moderately important for Arua, Zombo and Moyo. In Nebbi, the greater proportion of food energy needs was obtained from food produced on farm. This could be related to the fact that off farm income sources contribute minimally (<15%) to households in Nebbi, making farming the most important contributor to food security in Nebbi.

The results on food security agree with WFP (2011), where Uganda is generally categorised as not lacking food (>72.4% of households are categorized as food secure), though highly varying patterns of food insecurity across AEZs and seasons are recognised. Previous studies in Uganda have indicated that West Nile region is one of the areas with food stress most of the year attributed to among other factors, over-selling of produce by households immediately after harvesting, due to persistent high demand created by the neighbouring countries (DR Congo and South Sudan) for food commodities. According to UBOS &BOU Cross Border Survey Report 2011, agricultural products constituted 36.1% of the total informal exports in 2010, with 37% of the total informal destined to Sudan.

This assertion from UBOS and BOU should be taken with seriousness, in particular with respect to this study. Much as households have portrayed to be food secure, this has largely been as a result of both farm and off farm incomes that were converted to food energy needs. However, evidence from most studies in Uganda and West Nile in particular point to the fact that household incomes are not necessarily used to purchase food but attend to other needs such as school fees. For example, Lwasa et al. (2010) in their study on household objectives and achievement levels among Uganda's hot pepper, french beans and okra crops farmers, showed that school fees, investing in trade, buying land and livestock, and medical care topped the list of priorities, while consumption was ranked least. Subsequently household incomes were allocated in that order of priority. In this case, using incomes to conclude on food security status of households may have mixed reactions.

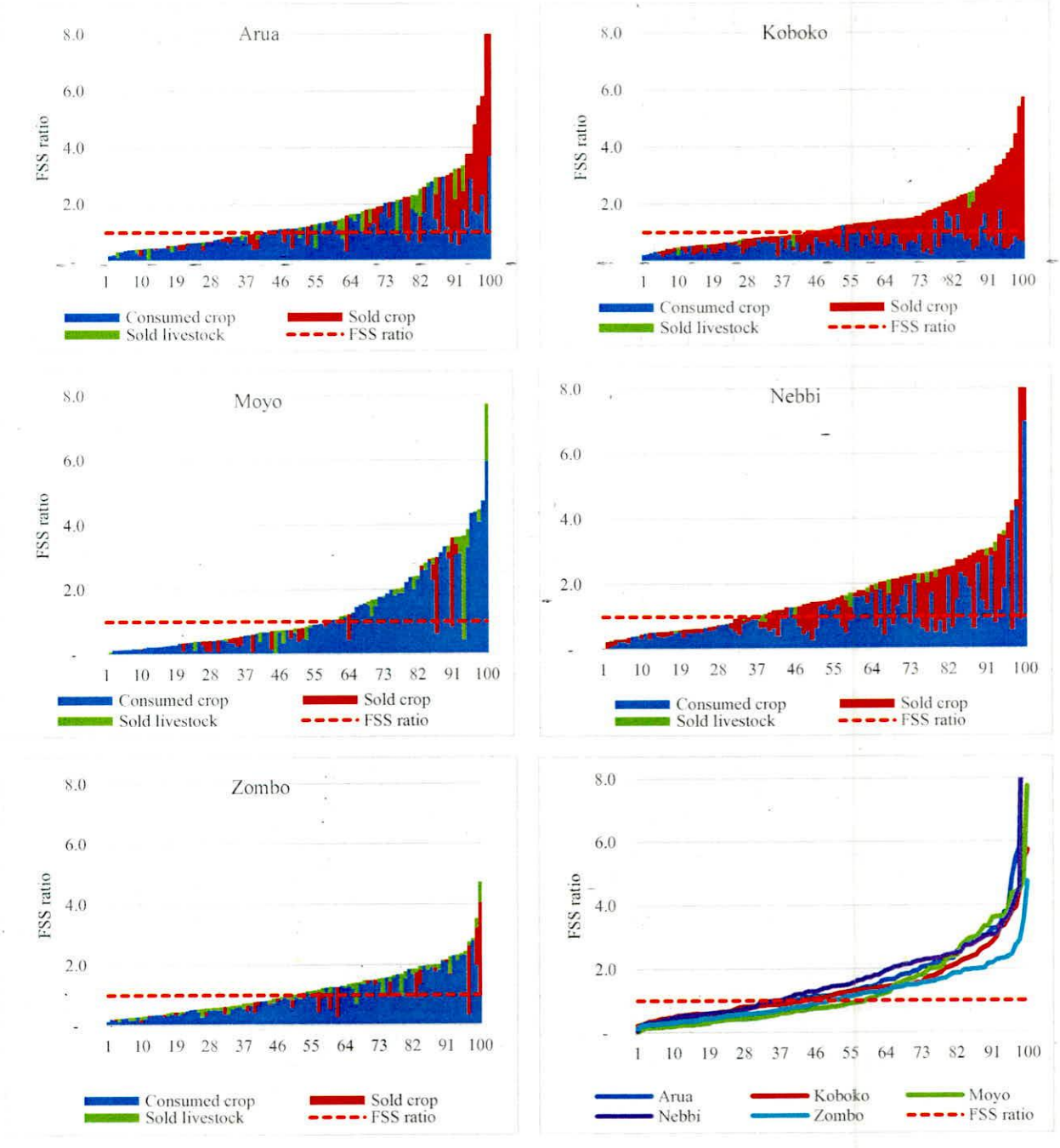


Figure 4: Food self-sufficiency ratio for the study districts in West Nile zone, Uganda (based on net farm income)

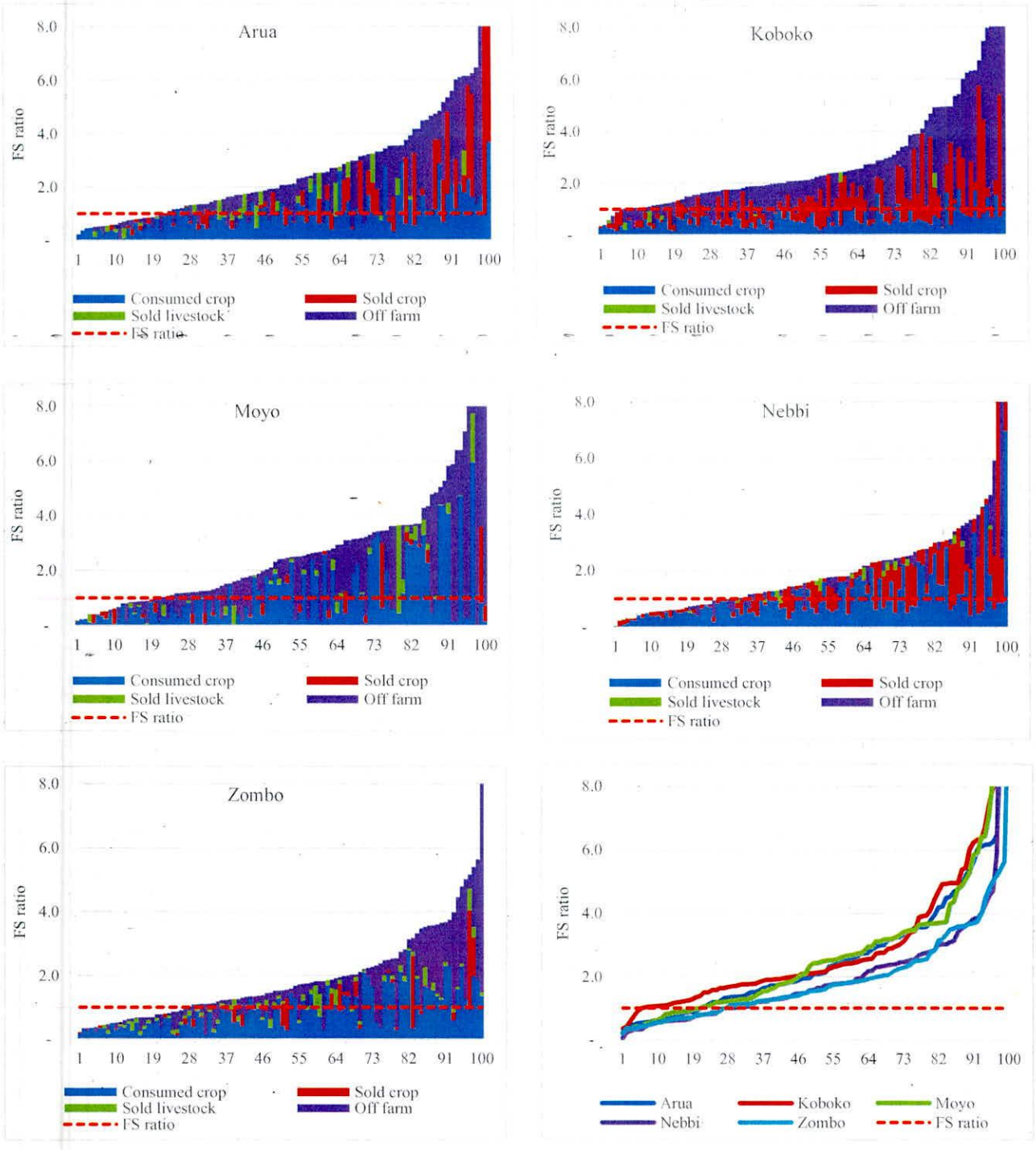


Figure 5: Food security ratio for the study districts in West Nile Zone, Uganda

The study further sought to understand the correlation between food self-sufficiency and food security with other farm explanatory variables – farm size, proportion of land allocated to food crops, total livestock units, and household characteristics such as total household income. Food self-sufficiency gap generally decreased with increase in farm size, proportion of land allocated

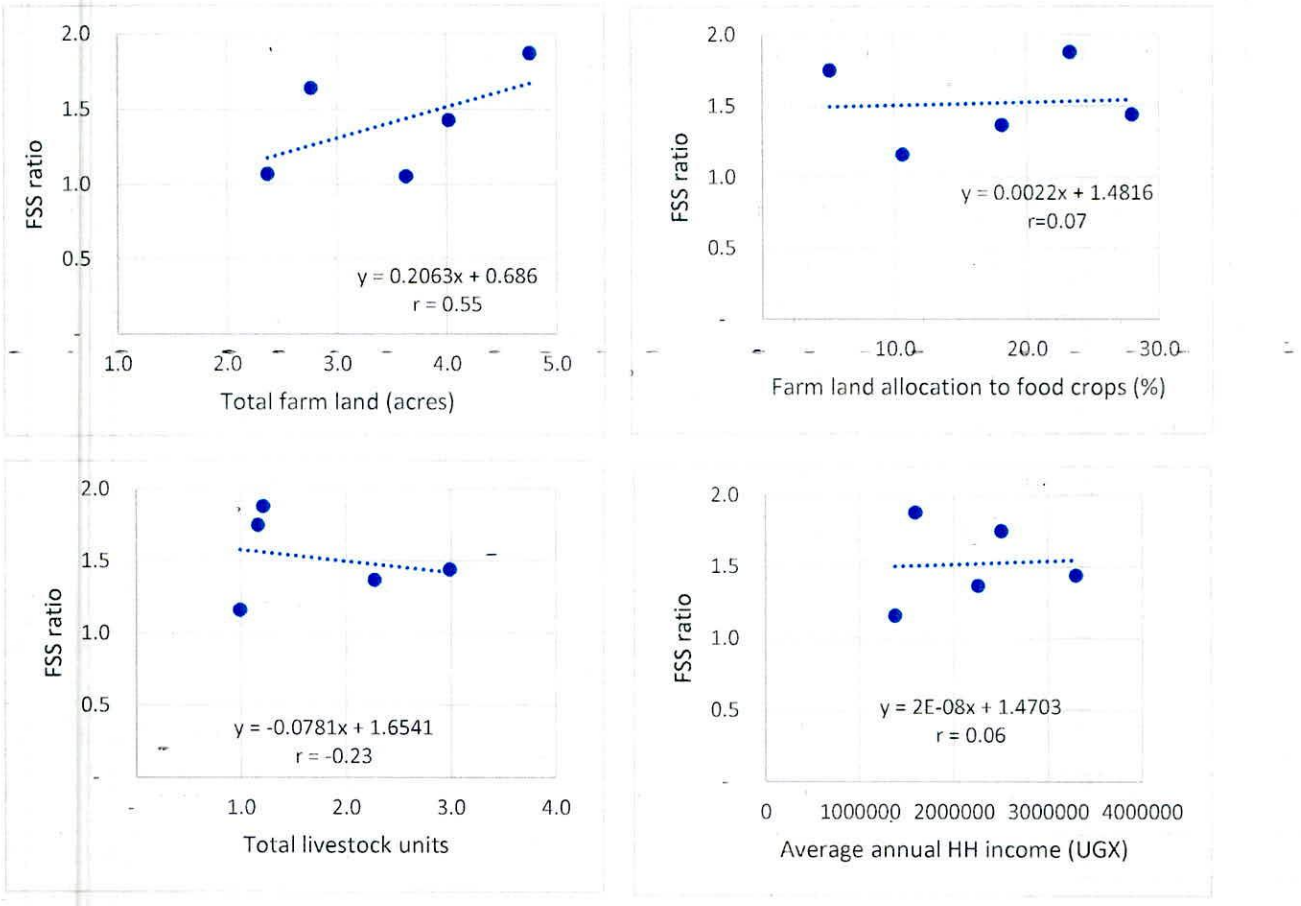
to food crops and household incomes (positive correlation coefficients) (Figure 6A). The larger the farm size, or the proportion of land allocated to crops, the high likelihood that households would reduce the FSS gap. On the other hand, livestock units showed negative correlation with FSS (r=-0.23).

Food security ratio showed strong positive relationships with both total farm land and total livestock units (Figure 6B). The possible relationship with livestock is that such households are able to invest in livestock[8] compared to their counterparts with limited off farm sources of income. Increase in farm size also showed a positive relationship with FS, but not as strong as FSS. It should be noted that the difference between FS and FSS was measured by the off farm sources of income and their respective contribution to household food energy. Therefore, more farm land would contribute to FSS due to more food production, but not necessarily to FS.

Assessing these relationships by district revealed interesting results. As shown in Annex 2, Food self-sufficiency and food security ratios generally showed likelihood to increase with increase in total farmed land across all the study districts. However, FSS ratio showed a weak negative relationship with proportion of land allocated to crops in Zombo and Moyo, while in Koboko, there was no observed relationship. Households with more land were likely to produce more food on farm, thus greatly improving their FSS, while allocation of more land to food crop enterprises as opposed to other enterprises, may not likely improve FSS under the current conditions. Additionally, households with high FSS ratios are also likely to have higher incomes, observed from the positive relationship between FSS and total household incomes, across the five study districts. Similarly, FSS showed positive relationship with total livestock units across all the districts, except Koboko. This is slightly different from the average values obtained for the region (Figure 6), possibly as a result of averaging which may have introduced bias.

[8] There is a distinction between income from livestock (income from sales of livestock) and total livestock units (the total number of livestock (including poultry) on farm (standardized to TLU). While the contribution of the former to FSS is direct, for the latter it's not.

A)



B)

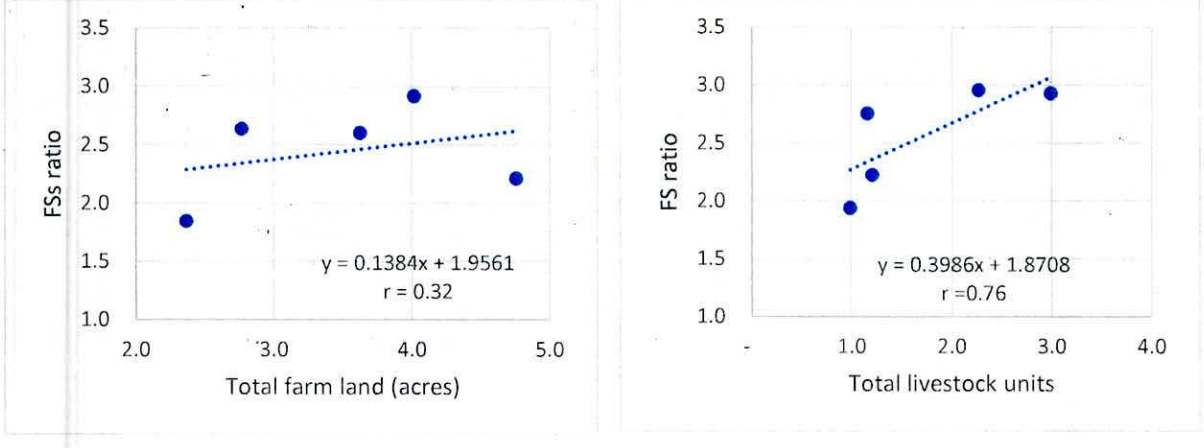


Figure 6: Relationship between food security and food self-sufficiency with farm characteristics

3.3 Characterization of household types in the study districts

3.3.1 Drivers of variability among households

Over 75% of the variability between farms was explained by four principal components. The first principal component, explaining 33% of the between-farm variability was dominated by income from sale of crops. The second principal component, explaining 22% of the between-farm variability was dominated by percentage of farm land under cash crops. The third and fourth principal components, explaining 12 and 10% of the variability between farms, respectively, were due to earnings from trade and percentage of farm land under food crops, respectively (Table 2). These components also define the major livelihood strategies pursued by households in West Nile. These fall into two broad categorisations as defined by Oumer et al. (2013); i) livelihood diversification, identified based on combination of cash revenue sources that contribute to total household income, and ii) agricultural production orientation, identified based on combinations of crop and livestock portfolios.

Table 2

Principal component (PC) scores based on correlation matrix of land allocation and revenue source variables in West Nile zone of Uganda

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
Number of years in savings and credit group	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01
Number of years in farmers' group	0.03	-0.03	0.00	0.02	0.02	-0.01	0.02	0.09
Number of years in farming	-0.03	-0.01	0.00	0.04	0.01	-0.27	0.08	**0.95**
Number of people in household	0.00	-0.01	0.00	0.00	0.02	-0.01	0.00	0.03
Number of household adults on off-farm labour	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.02	0.02
Number of household children on off-farm labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of farm land under ǂcash crops	-0.56	**-0.71**	-0.09	-0.25	-0.02	0.06	0.34	-0.03
Proportion of farm land under ǂfood crops	0.30	0.27	-0.08	**-0.77**	-0.17	0.06	0.45	0.03
Proportion of farm land under fallow	0.08	0.13	0.22	0.50	0.11	0.22	**0.79**	-0.03
Area (Acres) of land rented in or out	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Annual income from crops	**0.69**	-0.54	-0.29	0.08	0.13	0.01	0.01	-0.01
Annual income from livestock	-0.09	0.05	0.18	0.06	-0.43	**-0.64**	0.12	-0.21
Annual income from off-farm labour	-0.10	0.03	0.17	-0.01	-0.41	**0.68**	-0.18	0.19
Annual income from petty trade	-0.30	0.34	**-0.77**	0.07	0.22	0.03	0.09	-0.02
Annual income from formal employment salary	-0.09	0.06	0.44	-0.27	**0.73**	-0.03	-0.06	-0.02
Total land area (Acres)	0.01	0.00	0.01	0.01	0.00	0.00	0.03	0.00
Variability accounted for (%)	33.4	21.8	11.6	9.7	7.5	5.9	4.7	3.2
Cumulative variability accounted for (%)	33.4	55.2	66.8	76.5	84.0	89.9	94.7	97.8

ǂ*Apart from the traditional cash crops grown in the region (tobacco, cotton, coffee), any other crop with at least 70% of its yield marketed was considered to be a cash crop; If 30% or less of a given crop was marketed, then the crop was considered to be a food crop. If between 30 to 69% of the yield was marketed, then the crop was considered to be dual-purpose (both food and cash crop).*

3.3.2 Grouping of farm households according to drivers of variability

Using cluster analysis, households were grouped according to those pursuing similar livelihood strategies. At 60% coefficient of similarity, 3 groups of households were identified (Fig 7) to be designated as the farm types. There was a significant association between cluster and district in the West Nile region, according to a Pearson Chi Square test. Households from Arua, Moyo and Zombo districts were more likely to be cluster 1 and less likely to be in cluster 3 than expected. The reverse was true for households from Koboko district. Households from Nebbi district were more likely to be in cluster 3 and less likely to be in either cluster 2 or 1 than expected (Table 3).

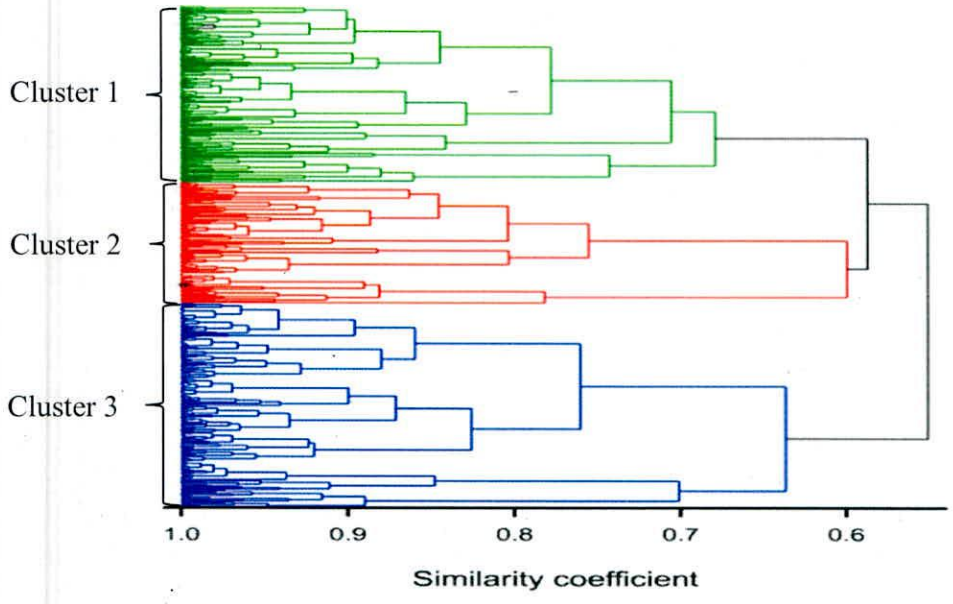


Figure 7: Dendogram of surveyed households (n = 500) in West Nile region showing their grouping into clusters taken as the farm types based on livelihood strategies

Table 3

Association between cluster of surveyed households and district

District	Cluster 1		Cluster 2		Cluster 3	
	Expected	Observed	Expected	Observed	Expected	Observed
Arua	35.2	**53.0**	24.0	22.0	40.8	25.0
Koboko	35.2	23.0	24.0	23.0	40.8	**54.0**
Moyo	35.2	**46.0**	24.0	29.0	40.8	25.0
Nebbi	35.2	10.0	24.0	09.0	40.8	**81.0**
Zombo	35.2	**44.0**	24.0	37.0	40.8	19.0
TOTAL	176.0	176.0	120.0	120.0	204.0	204.0
χ^2 value			122.215			
Asymp. Sig. (2-sided)			<0.001			
n			8			

Asymp. Sig. = 2-sided asymptotic significance

3.3.3 Household characteristics and livelihood diversification strategies of identified clusters

Household strategies pursued by the different clusters were analysed. In addition, the study examined the socio-economic characteristics of households in each cluster by comparing means of the variables representing household characteristics and access to institutional support services, natural capital (land ownership, livestock units), and human and financial capital, in order to understand. This helped create an understanding of the relationship between household characteristics and livelihood strategies pursued (Table 4).

Cluster 1 households pursued crop farming + petty trade + permanent off farm labour diversification strategies. Households in this cluster have relatively smaller farmed land (about 2 acres) and most of it is used to grow crops primarily for cash. However, only 22% of their total cash income comes from crop farming. They own relatively more livestock units and the contribution of livestock to household income is highest compared to the other two clusters. Apart from farming, they are also engaged in trade or other gainful occupation except formal salaried job. Net income is about UGX1.4 million, the lowest among the three clusters. This could be the reason they engage in several off farm activities as well as cash crop to try and raise their household incomes. It can be deduced that households in this cluster prioritize income maximization, i.e. they do not necessarily have to produce what they consume but rather seek to maximize revenue and from it. This hypothesis is got from analysis of percentage of land under 'cash crops', percentage of household income from petty trade, off-farm labour and livestock, which all seem to be high compared to those for other clusters.

Cluster 2 households pursued farming + formal employment diversification strategies. Households in this cluster have high percentage of land under dual-purpose crops (57%), and also a great proportion of households with formal employment (37%) from which they earn a regular salary. Formal employment contributes an average of 25% of total cash income for these households, following crop farming (27%). Net income is higher than cluster 1 households but lower than cluster 3 (about UGX4 million).

Cluster 3 households on the other hand pursue typically farm based livelihood diversification strategies. They are mainly farmers earning a large proportion of income from cropping compared to the other clusters (approximately 78%). Households own relatively larger farms

and land allocation to various crop enterprises – food crops, duo-purpose crop and cash crop, is in relatively equal proportions (about 30%). Households also have relatively high cash incomes, compared to clusters 1 and 2.

Table 4

Household characteristics as per the observed clusters in the study districts in West Nile zone

Household characteristics	Cluster 1 (N=176)	Cluster 2 (N=120)	Cluster 3 (N=204)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	22.84 (1.54)	27.16 (2.07)	78.46 (1.93)	792.101***	0.000
Livestock	14.49 (1.71)	8.84 (1.43)	1.53 (0.34)	310.289***	0.018
Petty trade	27.35 (2.29)	20.70 (2.51)	10.26 (1.51)	406.124	0.253
Regular off farm	14.63 (1.85)	4.21 (1.07)	2.49 (0.51)	289.708	0.173
Formal employment	0.79 (0.40)	24.84 (3.20)	1.73 (0.46)	180.046***	0.000
Remittance	4.29 (1.08)	6.21 (1.43)	2.14 (0.48)	213.292*	0.118
Natural capital					
Total land owned (acres)	3.14 (0.20)	3.17 (0.15)	4.02 (0.17)	128.861***	0.003
Total livestock units	1.95 (0.24)	1.83 (0.20)	1.47 (0.13)	499.53	0.220
Land use types					
Total farmed land (acres)	2.73 (0.15)	3.06 (0.15)	3.60 (0.14)	145.272***	0.001
Land_food crop (%)	6.96 (1.12)	8.81 (1.33)	30.61 (2.17)	193.5***	0.000
Land_duo-purpose crops (%)	12.31 (1.31)	57.25 (3.09)	28.64 (2.01)	277.021***	0.000
Land_cash crops (%)	66.86 (2.29)	26.02 (2.80)	30.94 (2.14)	306.668***	0.000
HH social factors					
Household size (#)	6.53	7.13	6.97	35.389***	0.018
Labour (# fulltime on farm)	2.4	2.2	2.5	24.763	0.419
Extension access (%)	83.91	79.49	92.23	11.066***	0.004
Membership to groups (%)	89.20	82.50	85.78	0.778	0.678
Livelihood outcomes					
Total cash revenue (million UGX)	1.75 (0.14)	4.03 (0.58)	4.43 (0.63)	806.911	0.312
Net income (million UGX)	1.42(0.14)	3.74(0.58)	4.11(0.63)	920.598	0.277
Food security (ratio)	2.19 (0.136)	3.20 (0.308)	2.45 (0.183)	161.323	0.412
Food self-sufficiency (ratio)	1.25 (0.07)	1.38 (0.10)	1.78 (0.15)	518.27	0.488

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

It should be noted that households in West Nile are generally pursuing almost similar crop enterprises with small variations across the districts, mainly defined by proportion of households growing the crop and proportion of contribution of particular crops to household incomes (ref to IITA/ZOA, 2014). Similarly, across the clusters, households seemed to engage in similar crop enterprises though with varying proportions (Table 5). Cassava remains the most important crop grown across the three clusters with over 80% of households growing the

crop. Cluster 1 had larger proportions of farmers growing beans, simsim, maize, and high value vegetables. Apart from beans, maize, simsim and vegetables had very high commercialization index across the study area (IITA/ZOA quantitative report, 2014). This possibly explains the commercialisation strategy for households in cluster 1.

Households in cluster 2, in addition to cassava, are mainly growing ground nuts, maize and sorghum. These are moderately commercialised, and households in this cluster also sell their crop in moderation. Cluster 3 on the other hand, seems to balance between food crops and also include both traditional cash crops (especially cotton) and non-traditional cash crops such as high value vegetables. Major crops grown, ground nuts, maize, simsim and vegetables are highly commercialised. Coupled with large farm sizes for households in cluster 3, this translates into higher contribution of crop income to household incomes and high household incomes.

Table 5

Proportion of households growing crop by cluster

Crop	Cluster 1		Cluster 2		Cluster 3		Total		Av. comm. index (%)*
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Beans	76	43	25	21	28	14	129	26	36.6
Cassava	143	81	105	88	188	92	436	87	45.2
Coffee	6	3	5	4	1	0	12	2	100.0
Cotton	2	1	2	2	28	14	32	6	100.0
Ground nuts	51	29	36	30	39	19	126	25	55.6
Irish Potato	6	3	8	7	4	2	18	4	80.6
Maize	41	23	31	26	36	18	108	22	49.5
Millet	9	5	7	6	16	8	32	6	21.0
Rice	3	2	5	4	12	6	20	4	
Simsim	22	13	12	10	34	17	68	14	72.7
Sorghum	28	16	30	25	32	16	90	18	45.9
Sweet potatoes	10	6	10	8	10	5	30	6	15.6
Tobacco	2	1	0	-	8	4	10	2	100.0
Vegetables (including okra)	24	14	12	10	35	17	71	14	99.6

*Commercial index, Source: IITA quantitative report, 2014

3.3.4 Household characteristics and livelihood strategies by district

Cluster analysis was also done by district using the same two criteria as above – livelihood diversification (on farm or off -farm), and agricultural production orientation (food crop, cash

crop or duo-purpose crop). In Arua, the majority of households (51%) pursued farming + employment livelihood diversification strategy. Households obtained a large proportion of their income from formal employment, crop sales and trade. Households also generally grew cash crops from which they earned the income. About 30% pursued farming + petty trade livelihood diversification strategy, with the least proportion (19%) pursuing mainly farming (Table 6). As observed from the previous analysis, households pursuing trade and off farm activities generally exhibited low incomes, and low rations for FS and FSS, compared to those pursuing mainly farm activities.

Table 6

Household characteristics as per the observed clusters in Arua district

Household characteristics	Cluster 1 (N=30)	Cluster 2 (N=51)	Cluster 3 (N=19)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	22.37 (3.25)	17.80 (4.41)	79.24 (5.62)	152.256**	0.043
Livestock	19.63 (3.89)	3.27 (1.62)	1.10 (1.10)	41.117	0.861
Petty trade	29.89 (3.99)	9.70 (2.56)	10.29 (3.17)	99.395	0.555
Regular off farm	16.57 (3.63)	1.98 (1.51)	4.15 (2.08)	44.282	0.908
Formal employment	1.02 (0.92)	59.11 (7.10)	1.47 (1.17)	84.569***	0.000
Remittance	4.92 (2.71)	5.28 (3.76)	1.88 (1.31)	17.529	0.487
Natural capital					
Total land owned (acres)	2.93 (0.41)	2.43 (0.28)	2.73 (0.29)	39.091	0.755
Total livestock units	1.07 (0.13)	1.62 (0.39)	0.95 (0.23)	148.749	0.604
Land use types					
Total farmed land (acres)	2.61 (0.23)	2.38 (0.26)	2.48 (0.23)	53.663	0.637
Land_food crop (%)	2.14 (0.91)	4.05 (2.61)	12.42 (3.91)	45.802	0.180
Land_duo-purpose crops (%)	9.88 (2.24)	27.24 (6.86)	25.89 (6.38)	73.599*	0.081
Land_cash crops (%)	72.38 (3.72)	61.75 (7.18)	56.19 (6.16)	87.262	0.442
HH social factors					
Household size (#)	6.49 (0.31)	7.68 (0.62)	6.60 (0.48)	22.700	0.419
Labour (# fulltime on farm)	2.89 (0.27)	2.41 (0.45)	2.93 (0.42)	32.153**	0.021
Extension access (yes=1)	0.81 (0.05)	0.91 (0.06)	0.76 (0.09)	1.820	0.403
Membership to groups (yes=1))	0.60 (0.07)	0.82 (0.08)	0.80 (0.08)	4.991*	0.082
Livelihood outcomes					
Total cash revenue (million UGX)	1.67 (0.28)	4.03 (0.40)	6.49 (3.72)	190.897	0.463
Food security (ratio)	2.06 (0.21)	3.48 (0.36)	3.58 (0.82)	200.000	0.447
Food self-sufficiency (ratio)	1.27 (0.10)	1.42 (0.22)	3.06 (0.72)	200.000	0.447

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

In Koboko, on the other hand, over 90% of households engaged in crop farming, and also earned the highest from crop farming (>40% contribution to household incomes). Three household clusters were generated but they did not exhibit significant differences in income

earning strategies, sources of household income or resource endowment, except there was significant difference in land ownership as well as total farmed land Table 7. This finding agrees with previous results (section 3.3.2), where households in Koboko were likely to be classified in cluster 3, and pursuing mainly farming activities. It should also be noted that much as households in Koboko are majorly farmers, they are also engaged largely in cash crop or duo purpose crop farming, and trading. Subsequently these contribute greatly to their household incomes and food security.

Table 7

Household characteristics as per the observed clusters in Koboko district

Household characteristics	Cluster 1 (N=5)	Cluster 2 (N=30)	Cluster 3 (N=52)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	68.25 (14.99)	64.68 (4.71)	56.08 (4.13)	170.570	0.269
Livestock	0	0	2.94 (1.23)	5.123	0.984
Petty trade	9.86 (3.42)	19.74 (4.90)	23.80 (3.96)	132.479	0.141
Regular off farm labour	1.06 (0.60)	2.01 (0.53)	6.60 (1.70)	124.528**	0.019
Formal employment	17.11 (17.11)	1.56 (0.91)	7.25 (2.80)	27.572	0.278
Remittance	0.29 (0.29)	0.99 (0.40)	2.41 (1.34)	33.502	0.148
Natural capital					
Total land owned (acres)	7. 00 (1.84)	4.06 (0.16)	3.15 (0.16)	86.566***	0.000
Total livestock units	2.65 (0.69)	2.13 (0.39)	3.61 (0.38)	162.567	0.302
Land use types					
Total farmed land (acres)	4.00 (0.89)	3.40 (0.18)	2.29 (0.16)	38.879*	0.083
Land_food crop (%)	51.34 (0.85)	48.17 (6.44)	10.84 (2.50)	62.279	0.036
Land_duo-purpose crops (%)	45.32(19.70)	35.80 (5.39)	29.30 (4.08)	40.374	0.366
Land_cash crops (%)	0	7.78 (3.32)	44.59 (4.61)	43.456	0.326
HH social factors					
Household size (#)	7.40 (0.01)	6.86 (0.42)	8.86 (0.46)	48.771***	0.009
Labour (# fulltime on farm)	2.40 (0.4)	2.43 (0.15)	3.25 (0.22)	11.944	0.611
Extension access (yes=1)	1	1	1		
Membership to groups (yes=1))	0.40 (0.24)	0.60 (0.09)	0.90 (0.04)	14.025***	0.001
Livelihood outcomes					
Total cash revenue (million UGX)	38.30 (7.00)	9.58 (4.63)	3.25 (2.31)	174.000	0.360
Food security (ratio)	5.18 (0.72)	3.05 (0.49)	2.13 (0.18)	174.000	0.443
Food self-sufficiency (ratio)	2.30 (0.45)	1.04 (0.11)	1.31 (0.11)	174.000	0.443

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

Similarly, in Nebbi, almost 90% of households earned their income from crop sales. Unlike in Koboko, the clusters generated for Nebbi showed significant differences for the pursued livelihood strategies and income sources (Table 8). Land allocation to various crops – food,

cash and duo-purpose was almost in equal proportions across the clusters, thus there is no dominant production orientation across the clusters in Nebbi.

Table 8

Household characteristics as per the observed clusters in Nebbi district

Household characteristics	Cluster 1 (N=69)	Cluster 2 (N=6)	Cluster 3 (N=24)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	83.64 (2.97)	64.67 (14.24)	79.42 (3.38)	146.943***	0.002
Livestock	3.54 (1.30)	1.78 (1.78)	4.31 (1.81)	45.310*	0.137
Petty trade	4.95 (1.66)	14.26 (14.26)	4.26 (1.68)	39.213	0.328
Regular off farm labour	2.08 (1.31)	0	0.12 (0.12)	4.440	0.815
Formal employment	1.29 (0.92)	18.13 (11.57)	6.48 (2.46)	51.970***	0.000
Remittance _	3.885 (1.01)	1.14 (0.87)	5.38 (1.87)	77.301**	0.066
Natural capital					
Total land owned (acres)	4.49 (0.28)	5.70 (0.34)	4.86 (0.37)	70.494***	0.007
Total livestock units	0.88 (0.19)	2.58 (0.93)	1.85 (0.84)	150.125***	0.005
Land use types					
Total farmed land (acres)	4.22 (0.26)	5.91 (0.35)	4.85 (0.37)	76.365***	0.003
Land_food crop (%)	18.80 (2.94)	33.91 (5.19)	34.31 (5.46)	126.164***	0.000
Land_duo-purpose crops (%)	24.86 (2.98)	48.76 (9.68)	37.95 (6.53)	124.801***	0.000
Land_cash crops (%)	44.13 (3.54)	12.33 (4.62)	23.55 (4.55)	93.000	0.510
HH social factors					
Household size (#)	7.17 (0.31)	6.83 (1.62)	7.00 (0.56)	19.586	0.720
Labour (# fulltime on farm)	2.52 (0.20)	2.50 (0.34)	2.04 (0.14)	6.590	0.883
Extension access (yes=1)	1	1	0.95 (0.04)	3.156	0.206
Membership to groups (yes=1))	0.98 (0.01)	1	1	0.439	0.803
Livelihood outcomes					
Total cash revenue (million UGX)	0.75 (0.04)	7.69 (0.99)	2.54 (0.15)	198.000*	0.085
Food security (ratio)	1.39 (0.11)	8.68 (3.06)	2.54 (0.18)	198.000	0.447
Food self-sufficiency (ratio)	1.27 (0.11)	5.86 (3.14)	2.17 (0.15)	198.000	0.447

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

In Moyo, households can be grouped into two distinct clusters. The main livelihood diversification strategy in Moyo was farming + petty trade (80% of the households). Regular off farm labour and livestock farming also played a key role in contributing to household incomes (Table 9).

Table 9

Household characteristics as per the observed clusters in Moyo district

Household characteristics	Cluster 1 (N=80)	Cluster 2 (N=1)	Cluster 3 (N=19)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	29.04 (3.67)	3.08	12.30 (3.38)	153.477***	0.011
Livestock	11.27 (2.39)	0	1.13 (0.58)	28.972	1.000
Petty trade	16.06 (3.29)	0	19.77 (6.32)	45.223	0.946
Regular off farm labour	15.30 (2.82)	0	5.48 (4.76)	26.118	1.000
Formal employment	2.71 (1.20)	96.9	33.29 (8.62)	147.662***	0.000
Remittance	7.16 (1.86)	0	0.15 (0.08)	28.711	1.000
Natural capital					
Total land owned (acres)	3.60 (0.26)	4	3.61 (0.48)	30.049	0.463
Total livestock units	1.98 (0.24)	1.3	3.56 (0.82)	182.828**	0.045
Land use types					
Total farmed land (acres)	3.25 (0.19)	3	3.56 (0.48)	21.763	0.971
Land_food crop (%)	16.22 (2.76)	66.6	23.87 (6.60)	73.412***	0.002
Land_duo-purpose crops (%)	25.58 (3.29)	0	17.54 (6.52)	25.581	0.999
Land_cash crops (%)	40.27 (3.69)	33.3	31.59 (6.85)	55.036	0.657
HH social factors					
Household size (#)	6.07 (0.23)	8	6.84 (0.70)	27.952	0.262
Labour (# fulltime on farm)	1.81 (0.10)	0	1.31 (0.13)	23.915***	0.008
Extension access (yes=1)	0.72 (0.05)	1	0.68 (0.10)	0.519	0.771
Membership to groups (yes=1))	1	1	1		
Livelihood outcomes					
Total cash revenue (million UGX)	1.17 (0.08)	42.1	5.01 (0.44)	200.000	0.295
Food security (ratio)	2.12 (0.16)	29.6	5.07 (0.77)	200.000	0.447
Food self-sufficiency (ratio)	1.45 (0.15)	0.7	1.07 (0.29)	196.743	0.472

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

In Zombo, the majority of households (71%) pursued crop farming+livestock+petty trade livelihood diversification strategies. The other two clusters (cluster 2 and 3) seemed to pursue similar strategies - crop farming + petty trade. All clusters exhibited a significant contribution from off farm sources of income towards household incomes, while contribution from crop sales is variable (Table 10). Trading is an important source of livelihoods for households in the three clusters.

Table 10

Household characteristics as per the observed clusters in Zombo district

Household characteristics	Cluster 1 (N=71)	Cluster 2 (N=6)	Cluster 3 (N=21)	Pearson Chi square	P-value
Contribution to total cash revenue (%)					
Cropping	33.85 (3.14)	29.68 (13.35)	16.38 (4.96)	187.143	0.304
Livestock	16.20 (2.06)	9.15 (4.21)	6.74 (2.64)	166.521**	0.017
Petty trade	26.00 (3.55)	34.81 (16.54)	43.88 (8.38)	152.989**	0.023
Regular off farm labour	5.04 (1.17)	0.29 (0.24)	9.15 (4.79)	107.247	0.203
Formal employment	0.76 (0.59)	1.21 (1.21)	8.87 (6.11)	23.594***	0.009
Remittance	5.01 (1.54)	0.34 (0.34)	0.45 (0.22)	34.947	0.519
Natural capital					
Total land owned (acres)	2.07 (0.13)	5.00 (1.07)	2.46 (0.26)	98.561***	0.000
Total livestock units	0.76 (0.10)	4.73 (4.01)	0.68 (0.16)	125.514	0.347
Land use types					
Total farmed land (acres)	2.05 (0.11)	4.98 (1.08)	2.45 (0.26)	106.556***	0.000
Land_food crop (%)	10.06 (2.49)	13.26 (7.48)	12.84 (3.96)	71.346***	0.003
Land_duo-purpose crops (%)	46.89 (4.66)	32.21 (14.61)	43.57 (8.24)	60.412*	0.108
Land_cash crops (%)	42.68 (4.70)	53.66 (15.64)	42.51 (8.88)	96.566***	0.008
HH social factors					
Household size (#)	6.15 (0.33)	7.16 (0.74)	7.09 (0.66)	31.853*	0.131
Labour (# fulltime on farm)	2.18 (0.09)	2.33 (0.42)	2.09 (0.18)	6.666	0.757
Extension access (yes=1)	0.77 (0.04)	0.83 (0.16)	0.85 (0.08)	0.734	0.693
Membership to groups (yes=1))	0.87 (0.03)	0.66 (0.21)	0.80 (0.08)	2.109	0.348
Livelihood outcomes					
Total cash revenue (million UGX)	0.71 (0.04)	6.56 (0.99)	2.58 (0.15)	196.000	0.293
Food security (ratio)	1.40 (0.09)	5.02 (1.28)	2.88 (0.30)	196.000	0.446
Food self-sufficiency (ratio)	1.01 (0.07)	2.57 (0.55)	1.21 (0.15)	196.000	0.446

Statistical significant at the 0.01 (***), 0.05 (**), 0.1 (*) level of probability
Figures in parentheses are standard error.

3.3.4 Food self-sufficiency and food security gaps of different household types

Gaps in food self-sufficiency for the various household types were evaluated (based on the overall clustering of households), as well as the adequacy of current alternative sources of income to close the gaps (Figure 8). Cluster 1 had the largest percentage of households that were less food self-sufficient (51%), followed by cluster 2 (46%) and lastly cluster 3 (38%).

With current alternative income sources, households in cluster one were able to make significant improvements in terms of food security. Only less than 19% remained below poverty line. Similarly, cluster 2 households made significant improvements, moving households to less than 13% as less food secure. Households in cluster 3 on the other hand did not make significant improvements in food security even with high incomes (highest among

the three clusters). The proportion of households that are less food secure is highest among the three clusters (22%). The probable explanation is that the incomes obtained by households in cluster 3 are mainly from crop sales (which actually contribute to a higher FSS). There are less off farm opportunities for cluster three and income from off farm sources is minimal thus would not cause a great shift in FS.

In cluster 1 and 2, the proportion of households whose primary occupation was farming was generally smaller than cluster 3 (cf Table 4). Household income in cluster 1 is low, but generally obtained from off farm sources, thus would have a positive influence on FS. Off farm income in this case, is important in moving households towards high food security.

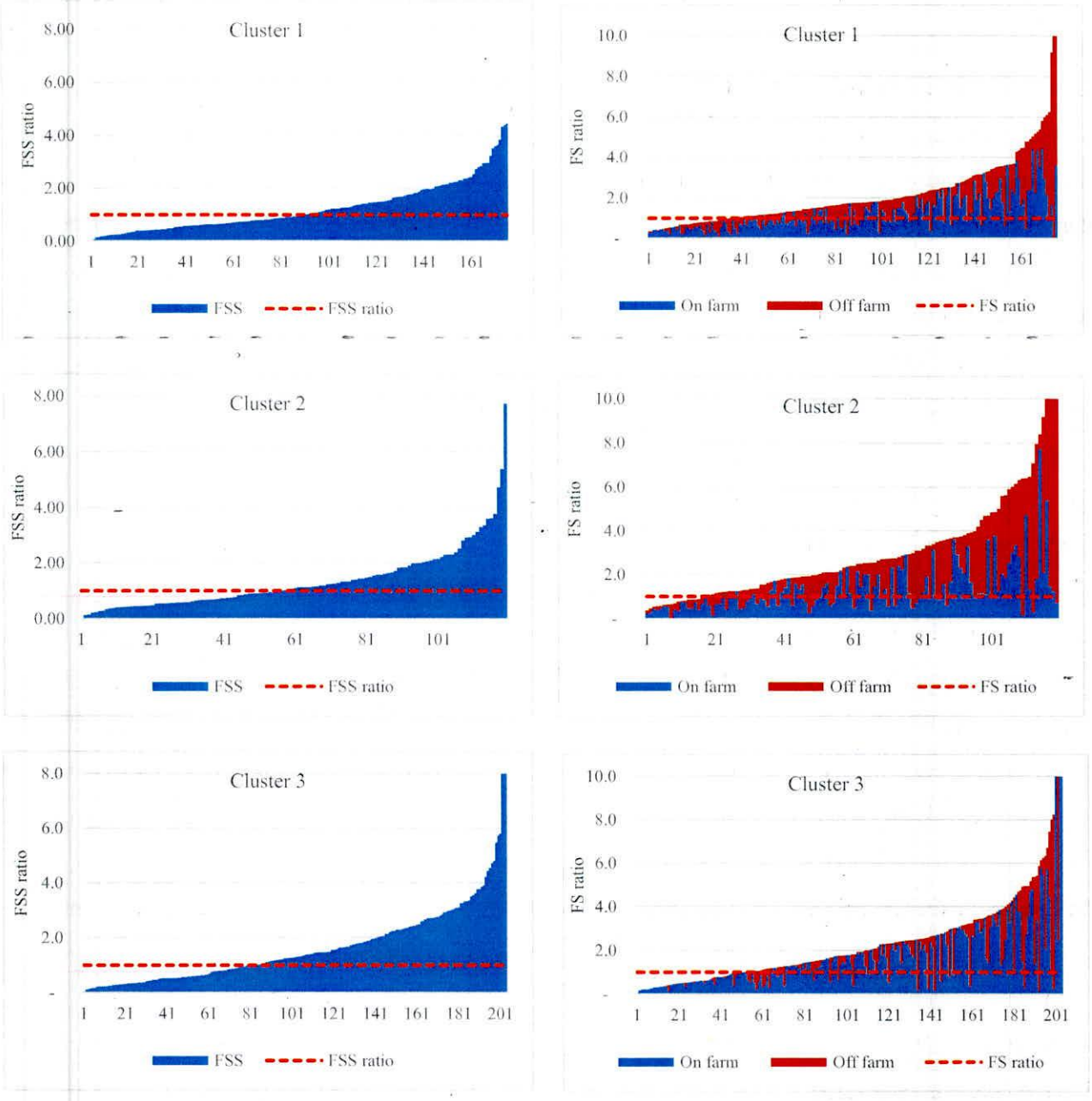


Figure 8: Food self-sufficiency gaps with current household food production and off farm sources

3.3.5 Household strategies and implications for food security and food self sufficiency

This study clustered households according to similar livelihood diversification strategies, and explored implications for food security and food self-sufficiency. Three farm clusters were obtained from the analysis based on the dominant livelihood diversification strategies – farming + petty trade, farming + employment, and farming majorly. These were subsequently named clusters 1, 2 and 3 respectively.

Cluster one comprised households whose focus was on cash crops as compared to food crops. They also owned relatively more livestock units as compared to other clusters. Despite the focus on income maximisation, their average incomes were the smallest among the three clusters. Their food self-sufficiency was lowest among the three clusters, however, if all available income was converted to food equivalent, the cluster would significantly improve the food security situation. Cluster 2 composed of households with various sources of income. Farming was done to ensure that they have enough food for their households, but obtained income from other sources.

Cluster 3 on the other hand, comprised mainly farmers (more than 85% earning their livelihood from farming) and crop income contributing more than 75% of total income. The households were generally endowed with larger farm lands, higher labour availability and higher household incomes. Food self-sufficiency ratio was highest for cluster 3 as well compared to the other two clusters. However, due to limited incomes from off farm, the food security situation was less likely to improve greatly, and a larger percentage of households remained below food security compared to other clusters (even when all the off farm income was converted into household energy needs).

More than half (n=296) of the surveyed households (cluster 1 and 2) depended mainly on off farm activities although not indicative of higher net income. This could be due to thin rural labour markets to make rural wage employment attractive for farmers, especially cluster 1 which largely depended on informal employment. Orienting this cluster of farmers towards input and output markets, through improving their skills in agricultural processing and marketing, may help build livelihood strategies with high economic return, for achievement of food security.

Results also showed that households pursuing majorly farming were more likely to have higher cash incomes, be more food self-sufficient and more food secure, compared to households pursuing off farm diversification strategies. Again this is related to the fact that households seeking off farm employment are engaged in low-wage employment (with the exception of those who had formal employment). Thus, supporting households engaged in farming to pursue higher return agricultural activities would go a long way in enhancing rural incomes and food security.

Food self-sufficiency was positively correlated with farm size and proportion of land allocated to food crops, while food security was negatively correlated with farm size. This is because farmed land determines farm output, which directly contributes to FSS. Unless farm production is substantially raised to meet all household energy needs, then farmers will continue to take on off-farm activities in a bid to supplement food available on farm, though empirical evidence has shown that this may as well not necessarily improve FS. Promotion of productivity enhancing technologies and practices is important for bridging the gap.

Lastly, from the cluster analysis, households were distributed across the five study districts, but the likelihood of being in either cluster one or three was higher than cluster two. Cluster 1 comprised mainly of households from Arua, Moyo and Zombo, while cluster 3 comprised mainly of households in Koboko and Nebbi. This clustering and associated household strategies agree to a large extent with the analysis done by district. This confirms that households of different types are found within geographical districts, as well as households of the same type in different districts, though in differing proportions. Thus conclusions based on district or geographical differences is not adequate given household heterogeneities even at small scale. It's important to design interventions based on household heterogeneities as opposed to geographical differences, since households may be heterogeneous even at a small scale.

5 REFLECTIONS AND CONCLUSIONS

This study confirmed that there exists variability in farming households in West Nile, largely explained by livelihood diversification strategies pursued by different households. The major livelihood strategies were crop farming, petty trade. Employment was pursued by a small proportion of households but was important for households in cluster 2. This has implications for targeting interventions in agribusiness as it determines the extent to which households would be willing to participate in activities requiring land re-allocation, for example. Results also showed that households of different types were found within districts, while similar households were also found across districts. This implies that stratifying households based on geographically contrasting regions/districts is a useful approach, but not sufficient to understand the heterogeneities of rural households.

Across the clusters, income sources largely explained the variability, but total household income and total livestock units were not significantly different across the clusters (cf Table 4), yet they are key determinants of food security. Ultimately, food self-sufficiency and food security were also not statistically significantly different across the clusters. However, households pursuing majorly farming were more likely to have higher cash incomes, be more food self-sufficient and more food secure, compared to households pursuing mainly off farm diversification strategies.

Targeting interventions for agribusiness should bear in mind the pursued household diversification strategies by various clusters. For household that are mainly farm-based such as those in cluster 3 (most of households in Koboko and Nebbi), it would be recommended to target on farm activities such as productivity enhancement and integration of high value crops to achieve both FSS and income improvement. It has also been noted that these households also depend on crop sales for their livelihoods, thus important to improve marketing at this level. The rest of the households seem to derive most of their livelihood from off farm, though they maintain on farm activities as well. Targeting agribusiness interventions to this category would focus activities that don't require full time on farm input such as agri-trade, input supply or information dissemination.

6 RECOMMENDATIONS

Based on household typologies, this study suggests the following criteria for selecting households and interventions (Table 11). However, given the uncertainty in validity of the clusters, this information is only indicative subject to validation of cluster by other measures proposed in this study.

Table 11

Household selection criteria and possible intervention enterprises

Cluster	Major characteristics	Candidate districts	Primary intervention objective	Interventions	Rationale
3	• Farm size >3 acres • Land allocation to food crop and duo purpose crop >60% • Full time labour> 2 persons • Proportion of income from crop >50% • Farming as primary occupation (measured by time spent on various activities)	Koboko (Kuluba) Nebbi (Kucwini, Wadelai)	Increase FSS	• Training in marketing strategies, post-harvest handling and market linkages • Productivity enhancement focusing on GAPs, fertility management	High FSS, but low FS due to reliance on farming alone which seems to be less adequate in meeting household needs. Already engaged in high value/cash crops thus need to enhance value addition and marketing.
1	• Farm size ≤3 acres • Land allocation to food crop and duo purpose crop <60% • Proportion of income from crop <50% • Trading plays and important role in addition to farming	Arua (Vuura) Moyo (Metu, Moyo rural) Zombo (Atiak) Koboko (Lobule)	Increase incomes	• Integration of high value crops • Productivity enhancement focusing on GAPs, fertility management • Marketing skills training	Have tried various ways to raise household incomes including selling more than 50% of crops and off farm income. Household incomes still remain low, but potential to improve FS exhibited if households could increase their incomes. Market oriented enterprises proposed.
2	• More off farm activities • More land under duo purpose crops	Zombo (Kango) Koboko (Kuluba)	Increase FS	• Agro-processing • Agri-trade • Input supply • Agricultural information	Reliance on the farm for income is limited.

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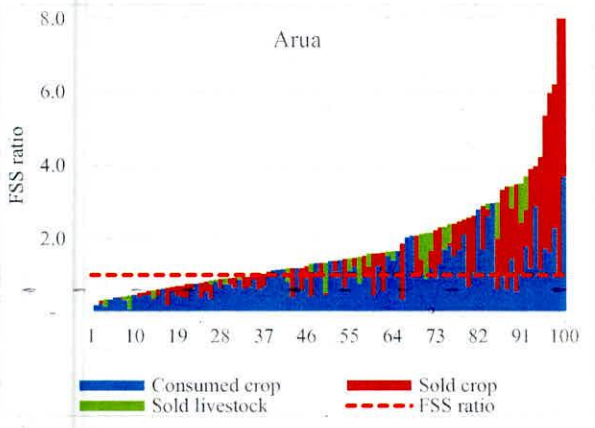
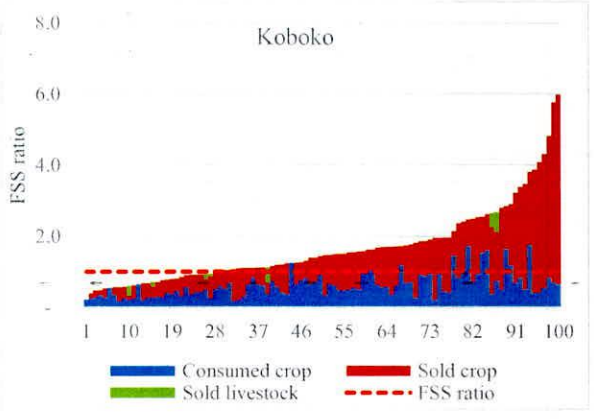
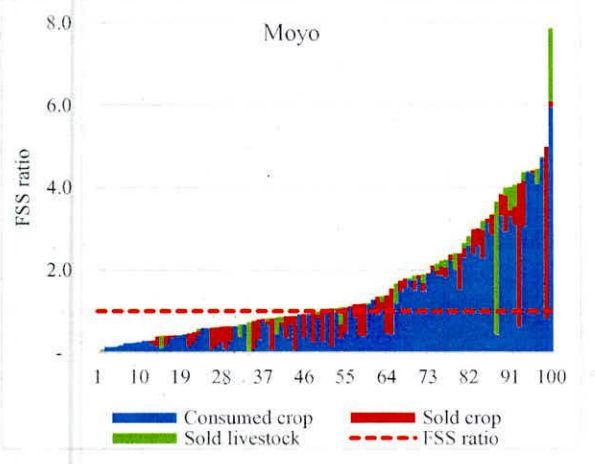
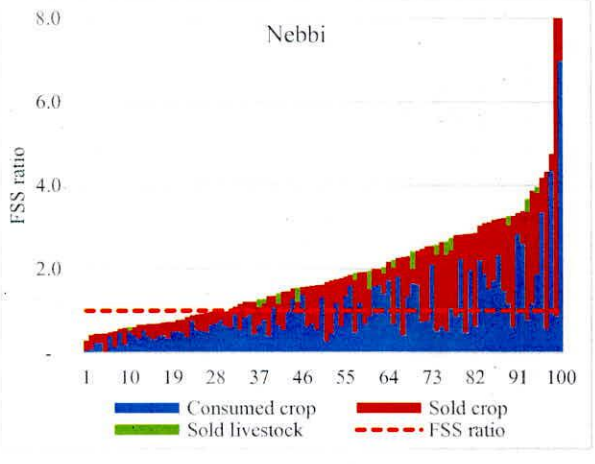
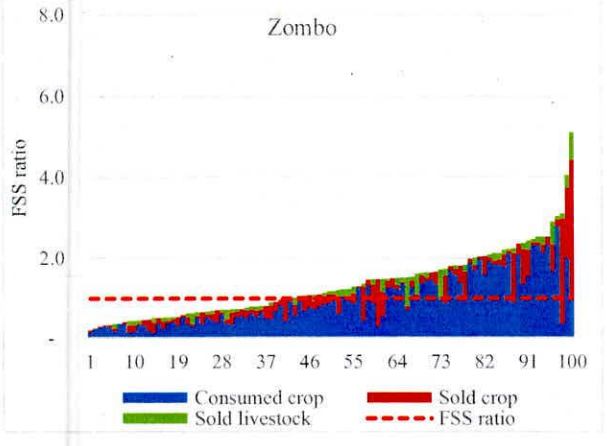
Annex 1: FSS ratios (cost of production not offset from farm incomes)

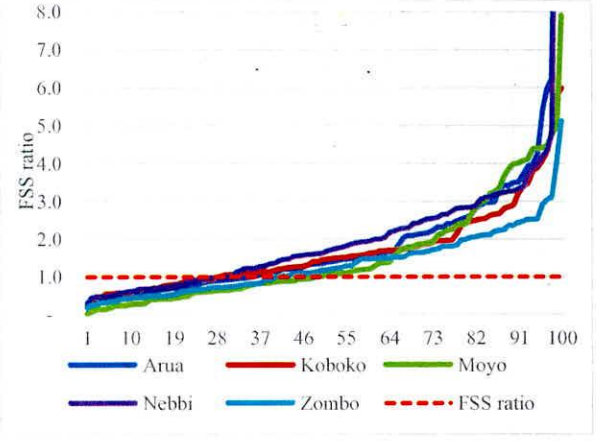






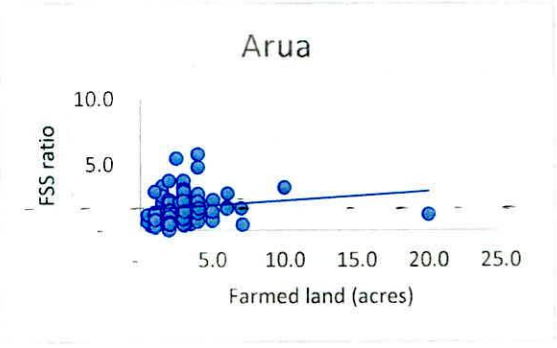


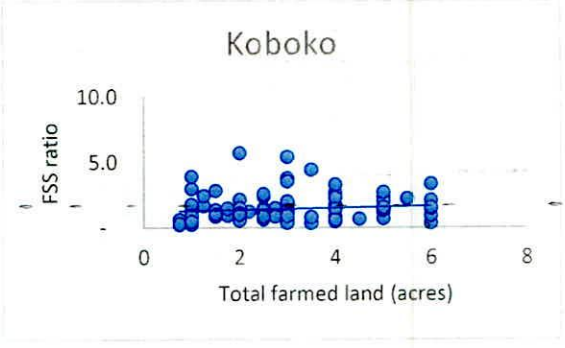


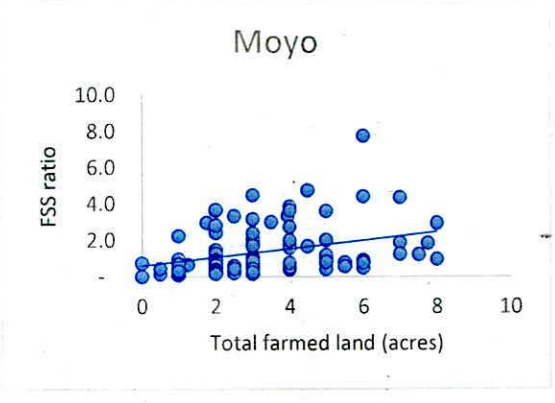


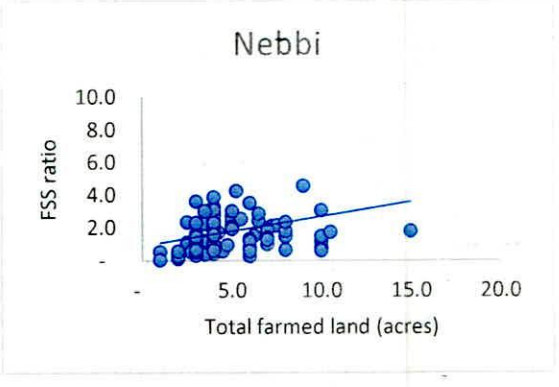
Annex 2 Relationship between food security and food self-sufficiency with farm characteristics by district

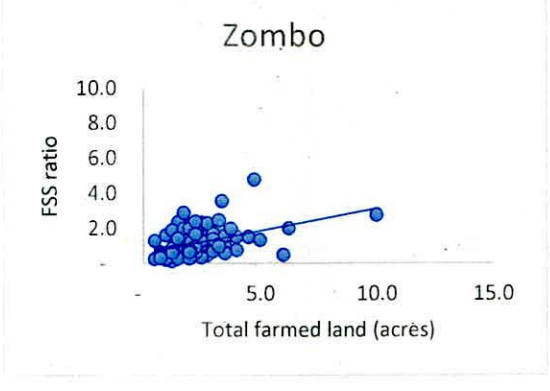
a) Food self-sufficiency and total farm land under cultivation



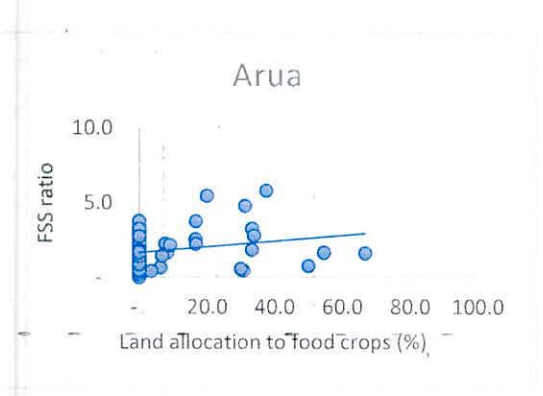


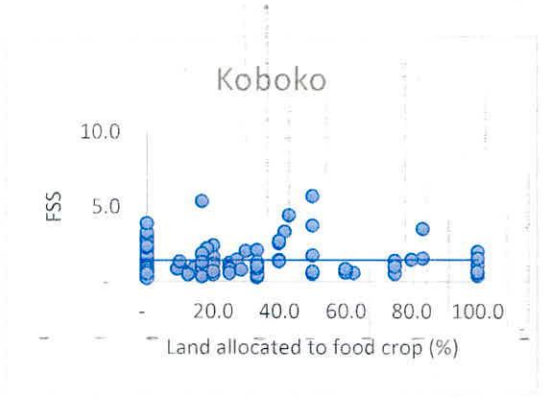


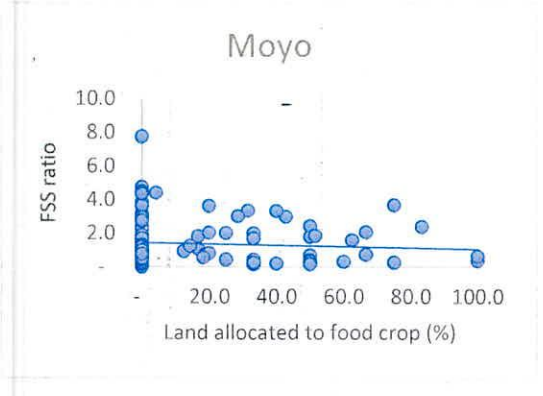


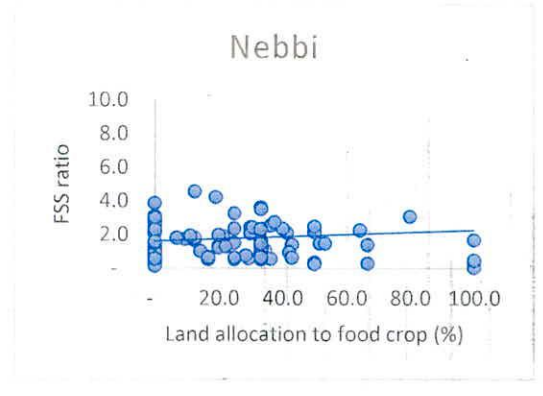


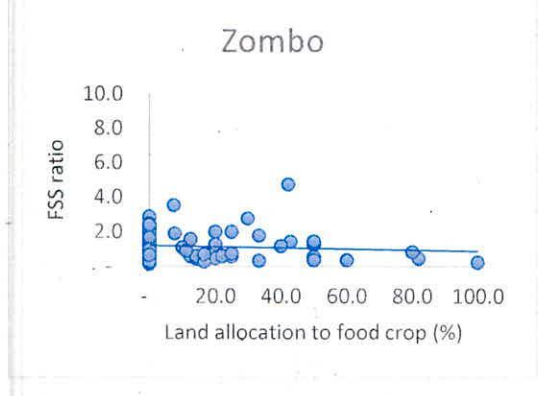
b) Food self-sufficiency and proportion of land allocated to crops



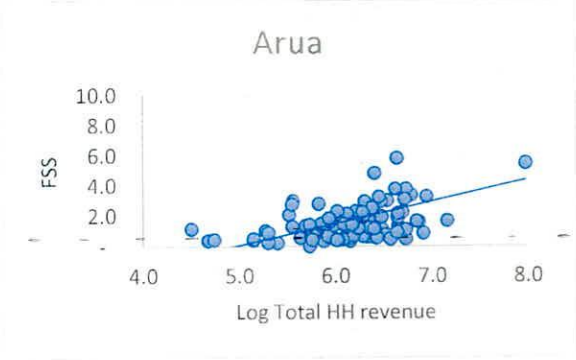


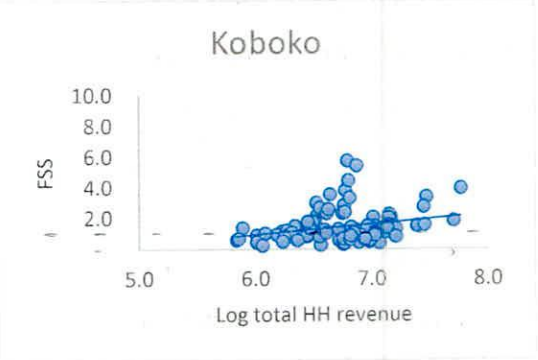


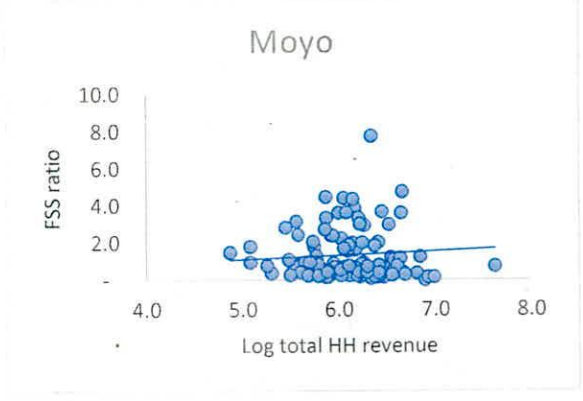


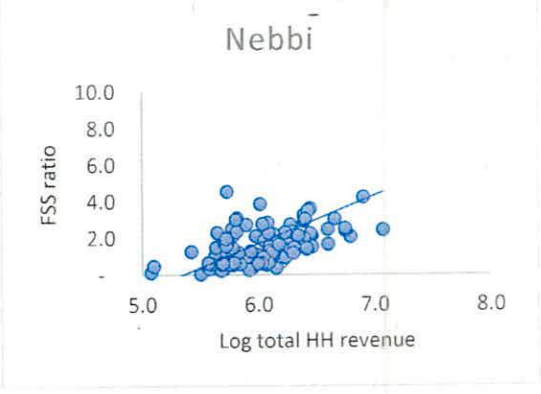


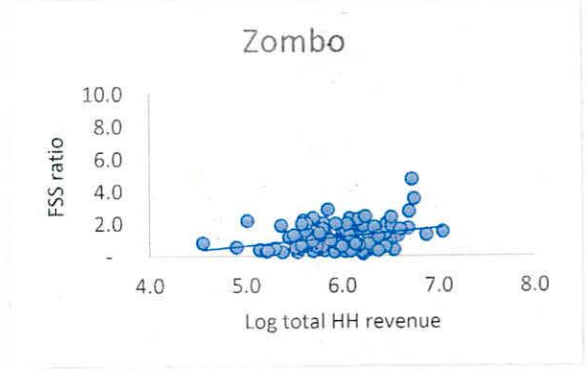
c) Food self-sufficiency and household incomes



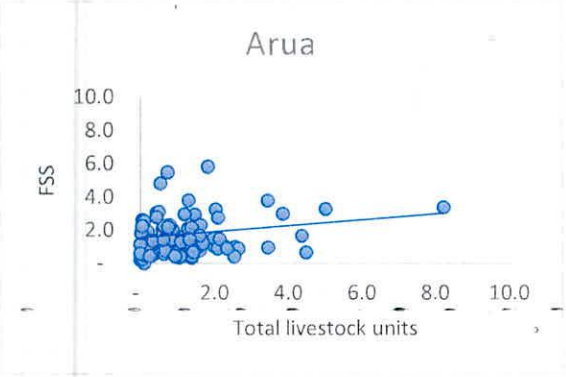


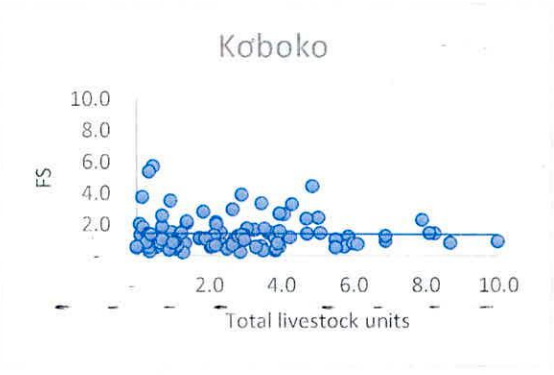


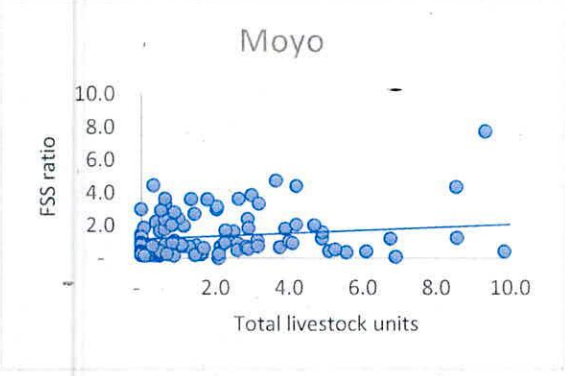


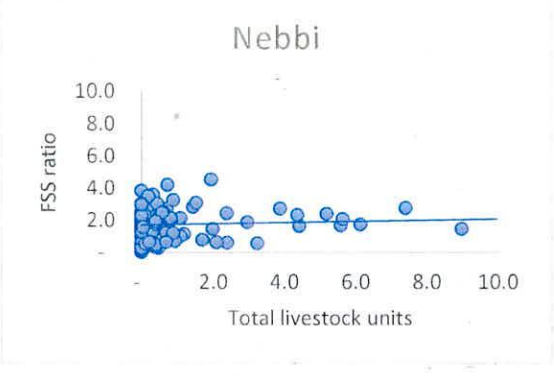


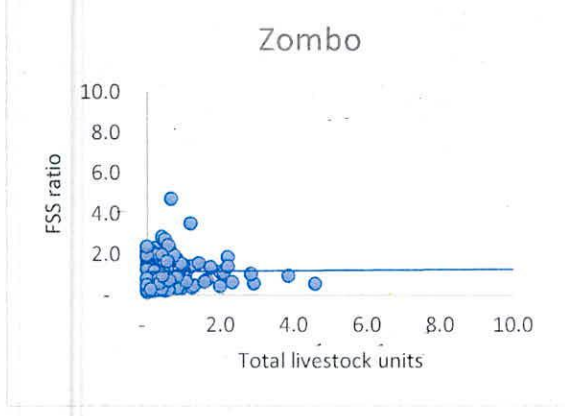
d) Food self-sufficiency and total livestock units



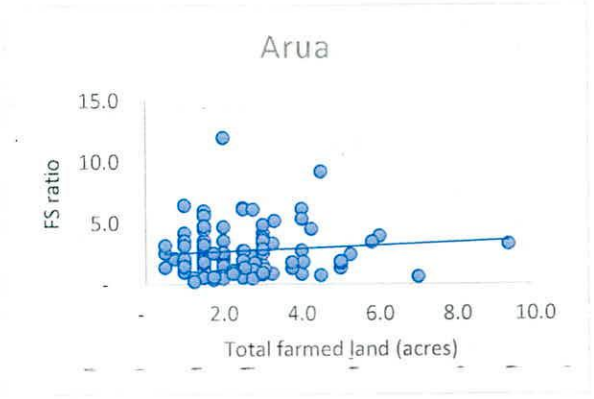


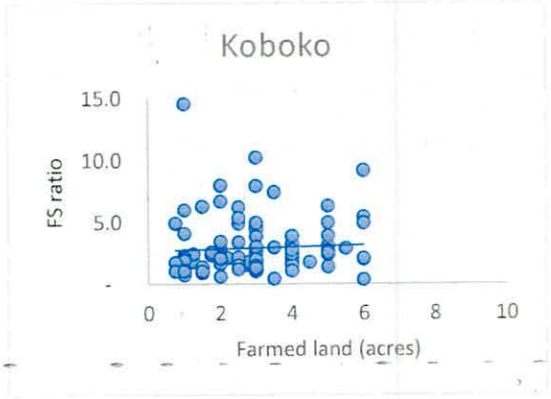


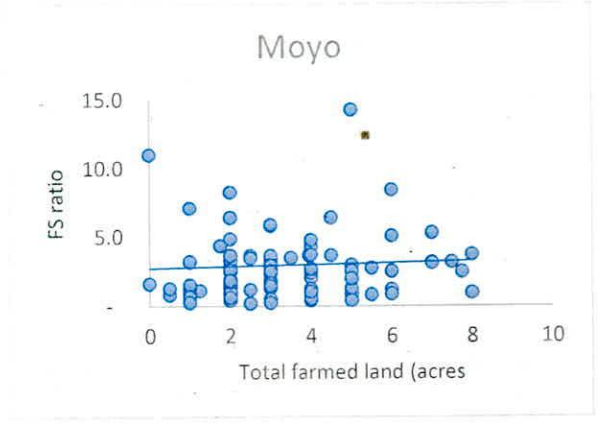


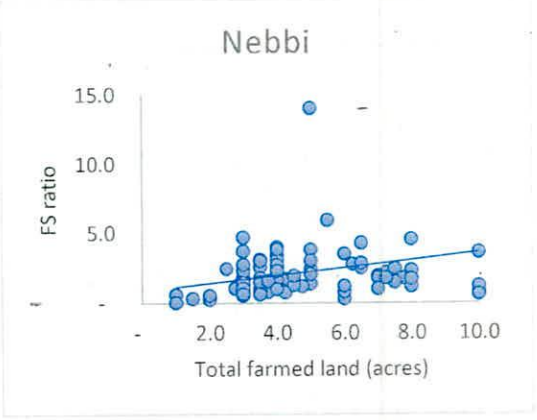


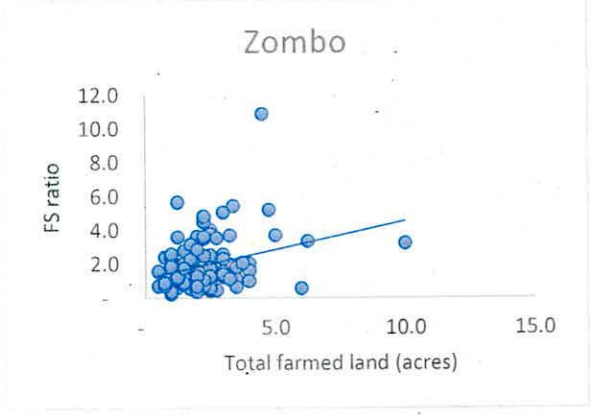
e) Food security and total farmed land



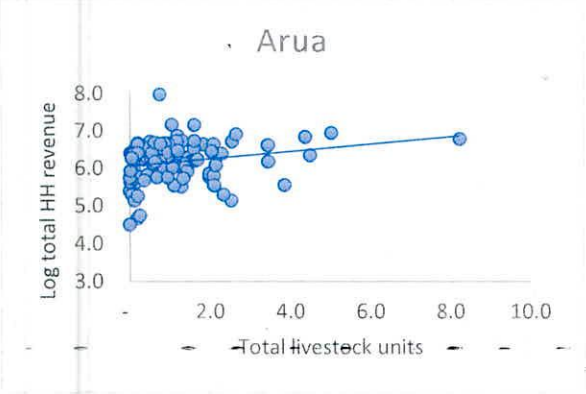


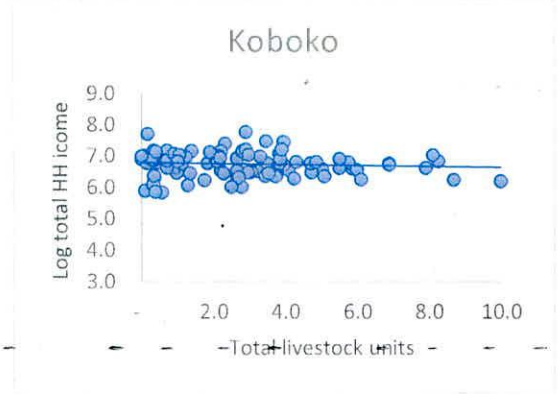


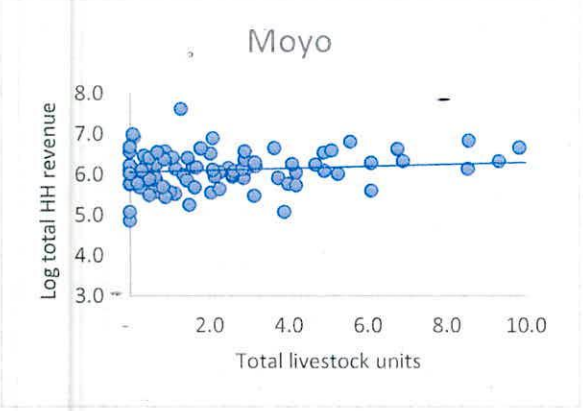


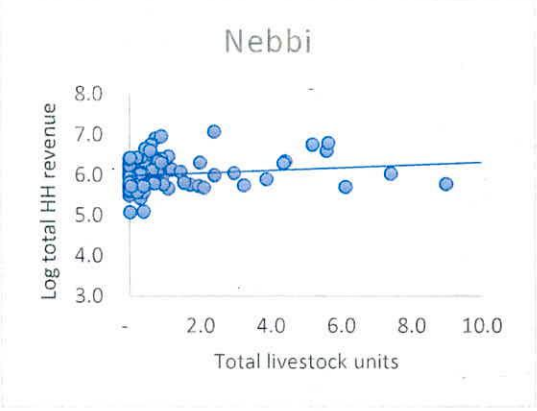


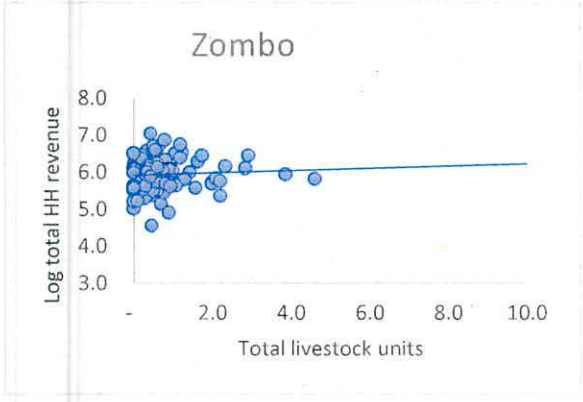
f) Total household revenue and total livestock units



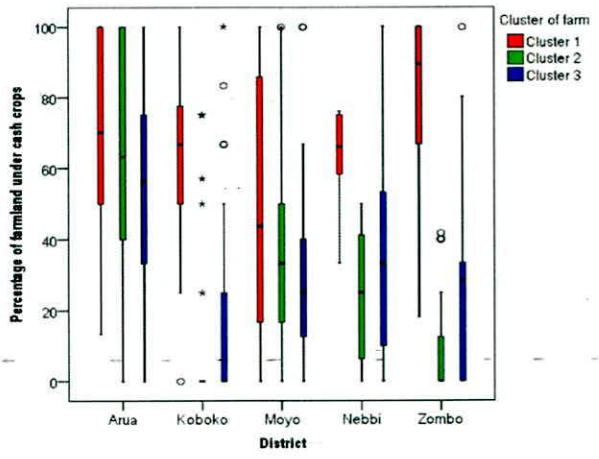


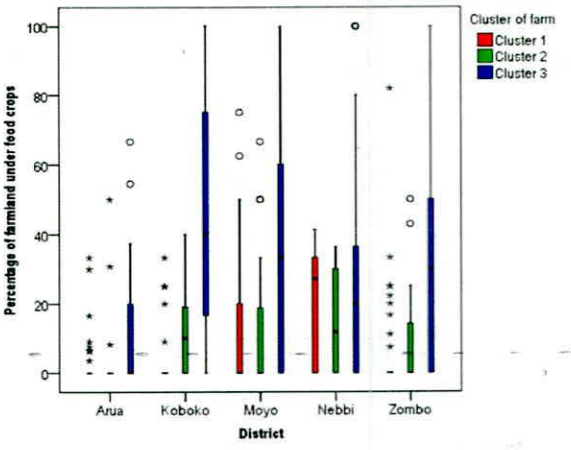


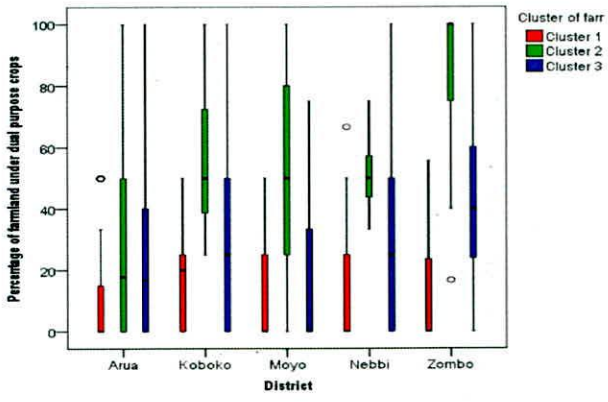


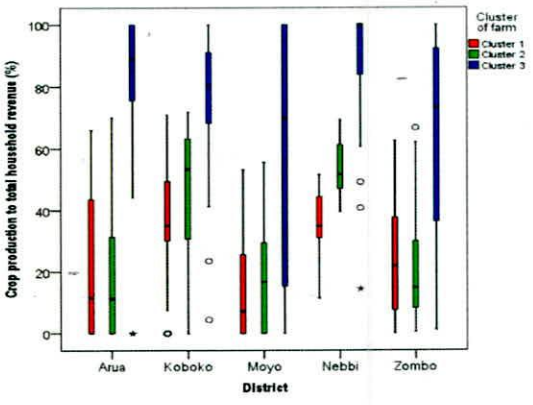


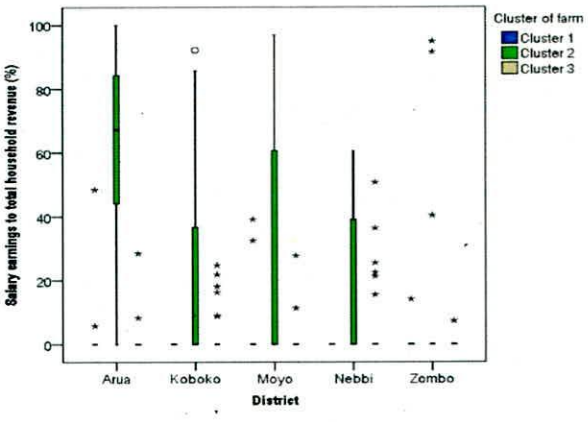
Annex 3

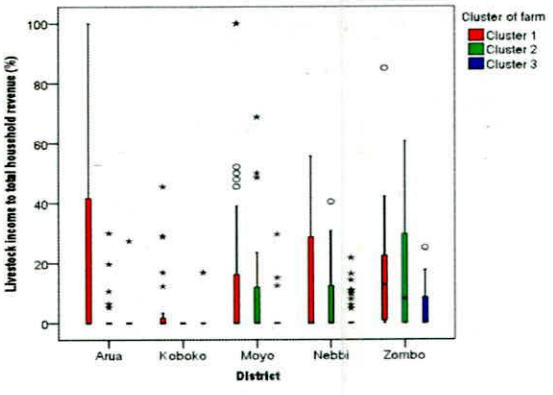

Percentage of farmland under cash crops
Cluster of farm
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District

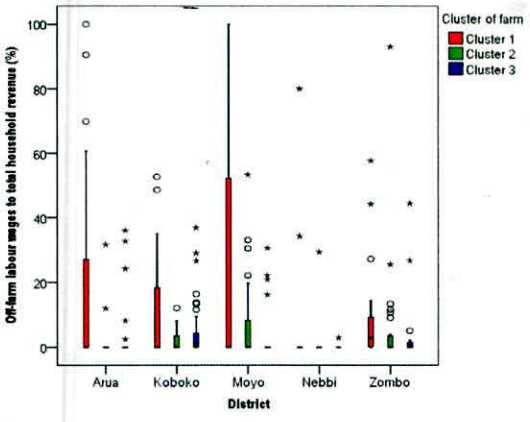

Percentage of farmland under food crops
Cluster of farm
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District

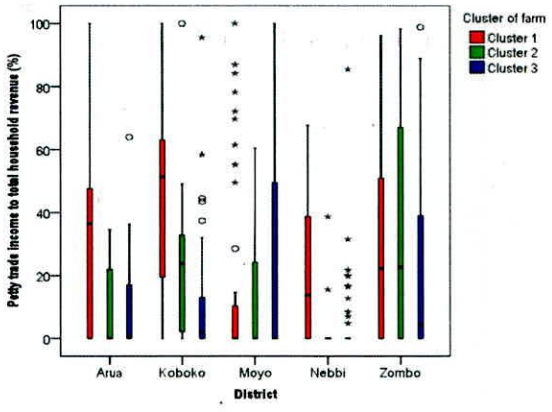

Percentage of farmland under dual purpose crops
Cluster of farr
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District


Crop production to total household revenue (%)
Cluster of farm
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District


Salary earnings to total household revenue (%)
Cluster of farm
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District


Livestock income to total household revenue (%)
Cluster of farm
Cluster 1
Cluster 2
Cluster 3
Arua
Koboko
Moyo
Nebbi
Zombo
District


Off-farm labour wages to total household revenue (%)
100
80
60
40
20
0
Arua
Koboko
Moyo
Nebbi
Zombo
District
Cluster of farm
Cluster 1
Cluster 2
Cluster 3


Petty trade income to total household revenue (%)
100
80
60
40
20
0
Arua
Koboko
Moyo
Nebbi
Zombo
District
Cluster of farm
Cluster 1
Cluster 2
Cluster 3